COUNTY EXPERIMENT FARMS IN OHIO

ANNUAL REPORTS FOR 1920 AND 1921

OHIO
Agricultural Experiment Station

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BULLETIN 361

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Dean State Forest, Steece

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[1]In cooperation with the College of Agriculture, Ohio State University, Columbus.
[2]In cooperation with the U. S. Department of Agriculture.

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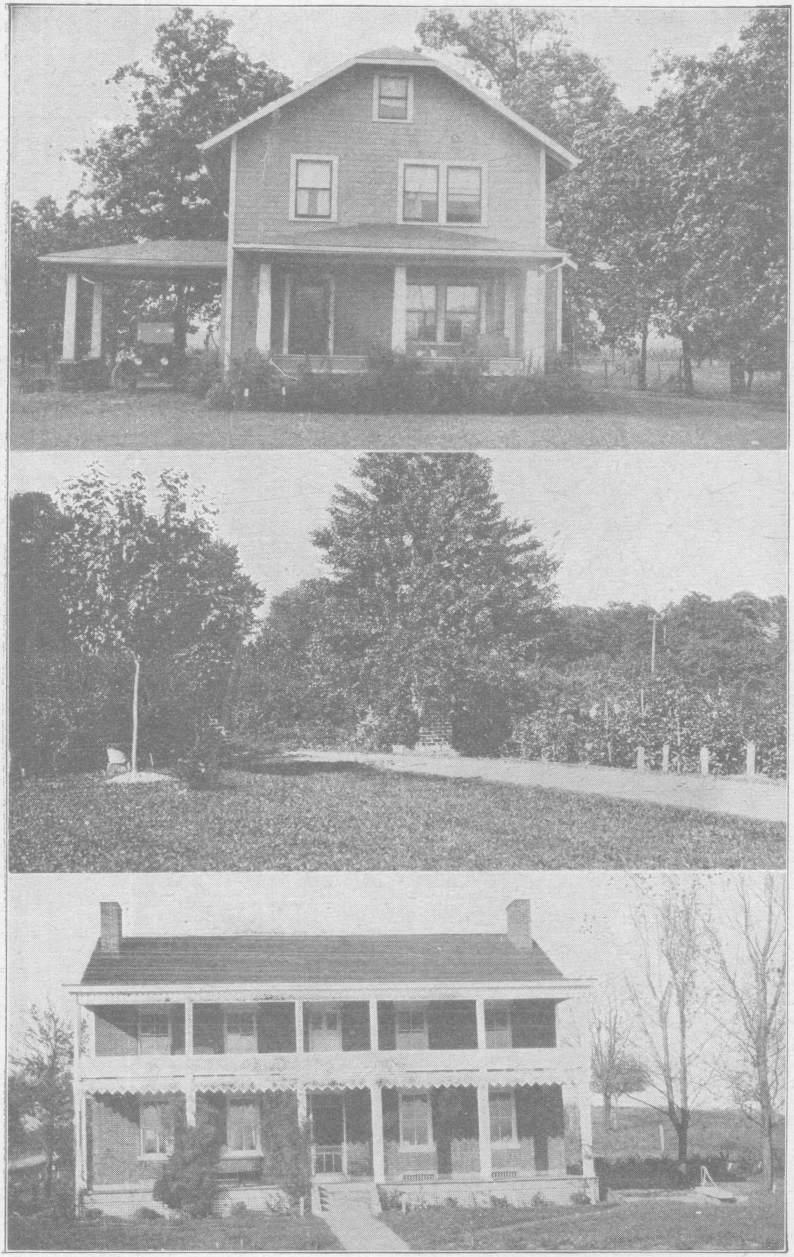

Residence, Madison County Experiment Farm
Entrance, Clermont County Experiment Farm
Residence, Belmont County Experiment Farm

BULLETIN
OF THE
Ohio Agricultural Experiment Station
NUMBER 361 JUNE, 1922

COUNTY EXPERIMENT FARMS IN OHIO

PART I

THE MIAMI COUNTY EXPERIMENT FARM

TENTH AND ELEVENTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

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MIAMI COUNTY EXPERIMENT FARM

Troy, Ohio

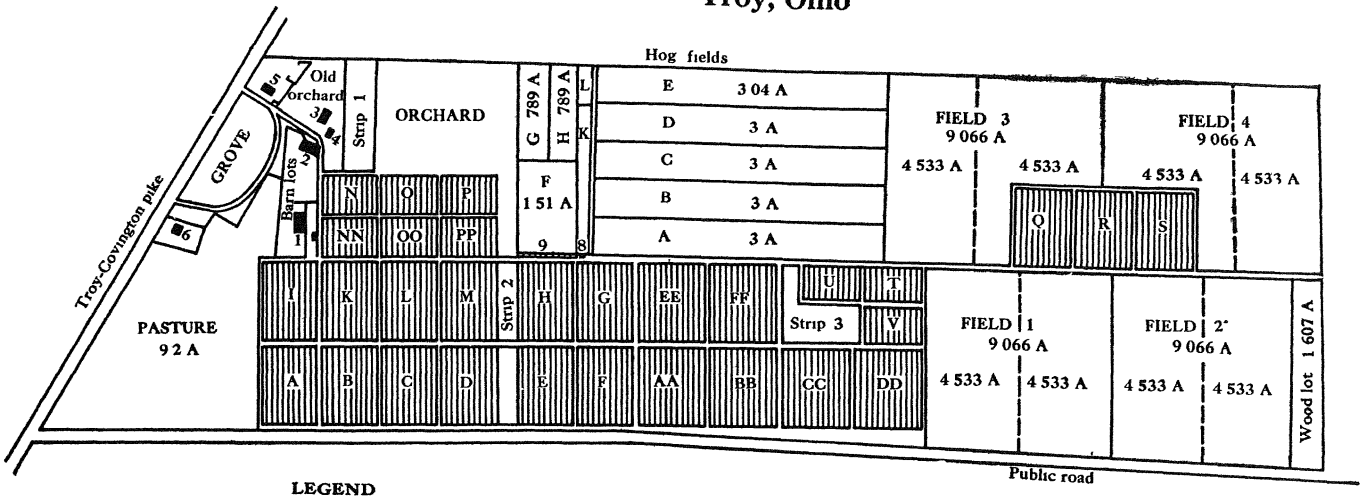


Diagram I

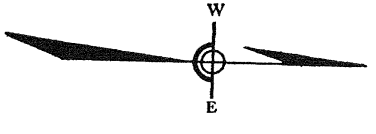
LEGEND

Blocks A, B, C, D, Fertility test, Rotation I
Blocks E, F, G, H, Fertility test, Rotation II
Blocks I, K, L, M, Fertility test, Rotation III
} Plots 1-10 acre

Block AA Alfalfa
Blocks CC, DD, EE, FF, Cereal variety test
Blocks N, O, P, Tobacco Rotation (IV) Fertility test
Blocks NN, OO, PP, Tobacco Rotation Variety test
Blocks T, U, V, Potato Rotation (VI) Fertility test
} Plots 1-20 acre

Blocks Q, R, S, Cereal 3-year rotation (V) Fertility test Plots 1-10 acre
Block BB, Rotation test

1-10 acre plots 272 1-4 ft. x 16 ft.
1-20 acre plots 136 1-8 ft. x 16 ft.
Paths 3 ft. wide
T, U, V, are 1-23 acre
118 36 ft. x 16 ft. 3 ft. paths
1 New barn, 2 Old barn, 3 Corn crib, 4 Tool shed, 5 Main house, 6 Tenant house.



FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$18,505.00	$18,505.00
Permanent improvements from 1917 to March 1, 1920 and 1921	2,895.64	2,934.89
Permanent improvements made during year ended March 1, 1921: Buildings, $7.40; gravel; for roads, $21.85; plantings in grove, $10—total	39.25	
March 1, 1922: Hog house and heater, $111.89; fence, $162.87; grading, $20.23; watering trough, $8.19; blowing stumps, $10.75; concrete feeding floor and well curb, $209.68; outfit for kitchen sink, $11.99—total		535.60
Total permanent investment	$21,439.89	$21,975.49
Operating equipment:		
Livestock.		
March 1, 1921: 4 horses and 3 colts, $1,300; 50 hogs, $805—total	$ 2,105.00	
March 1, 1922: 7 horses, $1,250; 48 hogs, $875—total		$ 2,125.00
Machinery, tools, and harness	1,763.00	1,546.00
Crops, feeds, and seeds:		
March 1, 1921: corn, $450; oats, $30; straw, $50; hay, $100; wheat, $190; tobacco, $225; tankage, $5; seed corn, $15; soybean seed, $140—total	1,205.00	
March 1, 1922: corn, $450; oats, $24; hay, $72; straw, $20; tobacco, $751; tankage, $30; ground feed, $11; seed corn, $10; soybeans, $400—total		1,092.00
Drain tile	40.00	30.00
Office furniture	40.00	35.00
Containers	34.00	25.00
Hog equipment	375.00	660.00
Building material: lumber $20; cement, $3		23.00
Sundries:		
March 1, 1921: Fertilizer, $14; gasoline and oil, $6; coal, $5; twine, $2; fence wire, $5; plot stakes, $30—total	62.00	
March 1, 1922: Oil, $5; coal, $1; twine, $1; spray material, $5; plot stakes, $25; fence wire, $5—total		42.00
Total operating equipment	$ 5,624.00	$ 5,578.00
Total investment	27,063.89	27,553.49

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$ 993.95	$ 868.72
From Farm sales:		
Livestock:		
1920—Hogs,	1,639.13	
1921—Hogs, $1,438.70; horses, $150; service fees, $8—total		1,596.70
Crops:		
1920—Oats, $9.72; potatoes, $38.34; soybeans, $7; straw, $1.50; fodder, $6; wheat, $827.63—total	890.19	
1921—Oats, $18.89; wheat, $552.27; tobacco, $197.67; soybeans, $71.50—total		840.33
Sundries	13.70	2.75
Total receipts	$3,536.97	$3,308.50
Balance forward March 1	3,087.54	2,088.69
	$6,624.51	$5,397.19

Cr.

By Expenditures

For labor	$2,159.14	$2,433.50
For current expense	2,110.03	1,492.15
For permanent improvements:		
1920—Buildings, $7.40; gravel, $21.85; plantings, $10—total	39.25	
1921—Buildings, $64.85; concrete work, $68.44; fence, $101.60; sewer pipe, $3.60; dynamite, $9.85—total		248.34
For machinery and tools	152.40	29.75
For livestock: Hogs	75.00	
Total expenditures	$4,535.82	$4,203.74
Balance carried forward	2,088.69	1,193.45
	$6,624.51	$5,397.19

ITEMIZED CURRENT EXPENSES

	1920	1921		1920	1921
Seeds	$170.41	$ 86.03	Buildings maintenance	70.25	115.18
Fertilizer	214.58	115 30	Implement repair	$275.05	$309.04
Spray material	1.81	39.75	Engine maintenance	330.77	25.10
Containers	34.20	19.75	Oil and gasoline		203 73
Binder twine	15.00	17.50	Water system	40.93	25 90
Machinery hire	56.82	17 40	Fence maintenance	.50	17.36
Plot fixtures	14.55	3 51	Transportation	116 50	97.23
Horse shoeing	16.35	18 70	Communication	40.03	25.00
Livestock equipment	61 85	41 95	Publicity	18 45	27.05
Feed	480.42	200 67	Fuel	14.25	
Veterinary services	7.70	6.60	Miscellaneous hardware	8.57	16.71
Immunizing hogs	74.75	41.12	Steaming tobacco beds	22.23	
Livestock fees	10.00		Moisture test	1.50	
Livestock incidentals	12.56	21.12	Office supplies		.45
			Total	$2,110.03	$1,492.15

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of farm in acres	1920	1921
Cultivated	85.63	85.18
Orchard	4.	4.
Farmstead	6.4	6.4
Pasture	9.2	9.2
Woodlot	1.61	1.61
Roads (public)	4.	4.
Roads (farm)	11.66	11.81
Boar lot	.....	.3
Total area of farm	122.5	122.5

Plot Work

	1920			1921		
	No. of plots	Total acreage	Yield per acre	No. of plots	Total acreage	Yield per acre
Corn	69	6.9	61.5 bu.	69	6.9	59.8 bu.
Oats	31	3.04	56.7 bu.	30	3.0	31.5 bu.
Soybeans	24	2.4	22.0 bu.	23	2.3	23.0 bu.
Tobacco	10	.5	808 lb.	10	.5	1408 lb.
Wheat	83	6.24	28.8 bu.	74	5.9	22.9 bu.
Wheat (spring)	1	.1	12.6 bu.	1	.1	5.5 bu.
Barley	1	.1	25.8 bu.	1	.1	27.3 bu.
Cowpeas	.....	.....	.....	1	.1	not threshed
Hay (soybean)	1	.1	2.07 tons	1	.1	1.75 tons
Hay (alfalfa)	12	1.2	4.20 tons	12	1.2	2.70 tons
Hay (clover)	60	6.9	1.20 tons	60	5.0	1.35 tons
Total	292	27.48	.....	282	25.2	.....

Field Crops

	1920		1921	
	Acres	Yield per acre	Acres	Yield per acre
Corn (husked)	18.06	62.4 bu.	20.30	63.2 bu.
Corn (hogged off)	9.00	30.1 bu.	9.00	46.8 bu.
Oats	5.43	57.8 bu.	.....	.....
Rye (hogged off)	3.00	20.0 bu.	2.05	11.4 bu.
Wheat	9.08	22.1 bu.	9.06	21.8 bu.
Barley and alfalfa (hogged off)	1.57	.....	.....	.....
Pasture (hogged off)	3.00	.....	6.08	.....
Hay (clover)	5.46	.....	1.40	1.3 tons
Bluegrass (Hogged off)	2.20	2 tons	.....	.....
Unharvested	1.30	.....	.....	.....
Rye	.....	.....	1.02	11.4 bu.
Soybeans	.....	.....	12.06	16.0 bu.
Rape (hogged off)	.....	.....	1.00	.....
Garden and truck	.....	.....	1.00	.....
Total	58.10	.....	62.90	.....

REPORT OF WORK FOR THE YEAR ENDED FEBRUARY 28, 1922

H. W. ROGERS

The 1921 season closes the eleventh year of work on the Miami County Experiment Farm. Much reliable information has been developed.

The farm program has been maintained to the extent that the most fundamental problems confronting Miami County farmers might be given consideration. Soil fertility, crop varieties, cropping systems, and hog-feeding experiments have been deemed most important.

Plans for carrying out these experiments are given careful attention and studied with an idea of working out a practical solution of some of the problems on Miami County farms.

FIELD WORK

A four-year rotation, corn, soybeans, corn, oats, is practiced in the field work. This rotation was planned with an idea of maintaining the fertility of the soil and at the same time producing as much corn as possible for hog feeding. Sweet clover is sown with the oats to be plowed under for the first corn crop; also a rye cover crop is sown after the soybean harvest to be plowed down for the second corn crop. Oats were made to follow the second corn crop rather than wheat on account of the scarcity of labor and high prices for corncutting. The labor cost for cutting the corn amounted to more than the value of the stover. While it has not been proved that soybeans are profitable to grow for hog feed, we have grown them in the past for experimental purposes.

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

		Corn	Oats	Soybeans	Tobacco	Wheat	Alfalfa Hay	Clover
		Bu.	*Bu.*	*Bu.*	*Lb.*	*Bu.*	*Tons*	*Tons*
Highest	1920	80.7	71.5	30.0	1,200	38.0	4.8	3.1
	1921	77.1	31.9	31.8	1,760	37.0	3.4	1.9
Lowest	1920	30.0	40.9	13.1	290	3.4	3.4	.4
	1921	24.3	21.9	7.5	940	6.6	2.0	.2

LABOR

	1920	1921
Number of work horses	5	4
Number of crop acres per horse	21.4	22
Number of man-hours beginning March 1	4,122	7,728
Number of horse-hours beginning March 1	6,839	3,578
Number of tractor-hours beginning March 1	111	230

PERMANENT IMPROVEMENTS

Labor and material costs for the permanent improvements made in 1921 amounted to a total of $654.47. It is distributed as follows: fences and maintenance $180.23, new buildings and maintenance for buildings $233.63, watering trough $8.19, blowing stumps $10.75, cement well curb $11.46, cement hog-feeding floor $198.22. The labor in each of the foregoing cases was done entirely by the regular farm help.

EQUIPMENT

Two teams in addition to a tractor took care of the 1921 work in the field. The fact that the tractor was an old model made its upkeep quite expensive. It is thought best to use the old tractor only for belt power or, perhaps, in emergency cases.

The feed cost for the horses did not run so high as the previous year. A cost of $138 per head included all feed, labor, shoeing, and miscellaneous expenses during this year. Three extra colts were broken preparatory to beginning the 1922 work.

The two corn crops and the oats each receives 250 pounds of acid phosphate and 35 pounds of muriate of potash, making a total of 750 pounds of acid phosphate and 105 pounds of muriate of potash per acre for the four years in the rotation.

An observation test of mulching wheat with straw failed to produce any noticeable results on the 1921 wheat crop. The winter was not severe, which, perhaps, accounts for this absence of benefit. As a whole, field crops did well this year. The corn averaged 63.25 bushels per acre, wheat 22 bushels, and soybeans 19 bushels.

HOG WORK

Hog feeding tests were continued during the season of 1921. A four-year rotation of corn, corn, rye, and clover is grown for hogging-down; and a field of continuous corn is hogged-off each season. Tests were also made with the hand-feeding of corn and rye. In all, six experiments were completed in the 1921 hog-work—namely: three tests in hogging-off corn; one hand-feeding corn; one hogging rye; and one hand-feeding rye. Each experiment was successfully conducted and some valuable information obtained.

TABLE 1.—HOGGING-DOWN CROPS ON MIAMI COUNTY EXPERIMENT FARM, 1921

Experiment	Growing cost per acre	Labor cost caring for hogs per acre	Yield per acre	Tankage cost per bushel	Pork made per bushel	Gross returns per bushel	Gross returns per acre	Net returns per acre	Market value of grain per acre	Gain by hogging off per acre over selling grain
			Bu.		*Lb.*					
I. Corn following clover.....	$16.76	$2.52	63.3	$0.043	11.2	$ .70	$44.31	$22.31	$25.32	$13.75
II. Corn following corn	16.56	2.13	51.1	.059	12.8	.896	45.79	24.09	20.44	20.21
III. Corn continuous	17.36	1.20	26.0	.045	10.1	.656	17.07	−2.66	10.40	4.30
IV. Hogged down rye.....	7.83	1.44	11.2	.227	26.4	2.58	28.83	17.09	4.48	20.37

The gains for the hogs were calculated on the market value at the close of each of the above experiments—viz.: Experiment I, $6.25 per cwt.; II, $7.00 per cwt.; III, $6.50 per cwt.; IV, $9.75 per cwt. The average weight of the hogs at the beginning of each test was as follows: I, 130.7 pounds; II, 87.9 pounds; III, 200.6 pounds; IV, 45 pounds. The growing cost in Table 1 includes labor for producing the crop, seeds, and fertilizer. The market value of the grain per acre is figured at the value of the standing grain in the field, or 40 cents a bushel for each crop. The yields are based on the actual weight of average rows.

In order that no information might be lacking in finishing these experiments a cost account was compiled for all operations and expenses in producing the crops. All labor, seeds, and fertility costs for the present year as well as the residual effects of the fertilizers from the preceding two years are tabulated. The costs of labor in caring for the hogs while on the tests and of supplementary protein feeds are included in the table.

The figures are reduced to the basis of one acre and one bushel. Interest on investment, machinery, and overhead charges are not considered.

The gain made per bushel of rye seems remarkably large and better than obtained in previous years. It may partly be accounted for by the fact that there was a fine crop of clover in the rye, and that the hogs also had access to an acre of clover in adjoining rye stubble. In 1920 when the crop of rye was much heavier, 20 bushels per acre, and the clover not so good, the gain was 11.7 pounds per bushel of rye. In 1919 the gain was 16 pounds per bushel of rye. In 1914 and 1916 the gains were 9.5 and 10.8 pounds respectively, per bushel of rye.

TABLE 2.—AVERAGE COSTS AND RECEIPTS PER ACRE FOR CROPS HOGGED DOWN IN 4-YEAR ROTATION

	Labor				Miscellaneous cost	Tankage cost	Pork produced	Gross receipts	Net receipts
	Man-hours	Horse-hours	Tractor-hours	Cost					
							Lb.		
Corn	22.5	31.0	1.50	$16.70	$2.58	$2.70	711.3	$44.46	$22.48
Corn	20.3	35.3	.83	15.78	2.91	3.00	654.6	45.82	24.13
Rye	7.3	11.0	.....	4.88	4.39	2.54	296.5	28.90	17.09
Clover	5.6	.....	.....	2.01	6.62	1.25	160.8	15.67	5.79
Average	13.9	19.3	.58	9.84	4.12	2.37	455.8	33.71	17.37

A cropping system for a hog farm involves a number of important considerations: it should adapt the rotations to soil and climatic conditions; rotate crops so that the largest amount of corn may be grown and at the same time maintain the soil's fertility; provide a succession of crops through the season for hogging; grow crops from which the hog can, as nearly as possible, balance its ration; provide a distribution of labor through the season; and reduce the man-and-horse-labor per rotation.

A further analysis of the four-year rotation of corn, corn, rye, and clover, Table 2, in the hogging tests, will give some insight into part of these factors. The 1921 cost-account work affords an opportunity to determine with accuracy the actual results from the rotation as a whole during the season.

As a foreword it should be said that at weaning time the pigs were turned on the clover pasture, later on the rye, and finally on the two fields of corn in turn, the corn in one of the fields being of an early maturing variety. The clover field served as a supplementary pasture throughout the season, and the young clover in the rye provided fall pasture. The figures in Table 2 are based on the average results per acre for the four crops in the rotation.

Fertilizer and seeds are included under the miscellaneous cost in Table 2. Corn was fed to the pigs while pasturing the clover, which is also charged in the miscellaneus cost. The experiment was begun at weaning time with the spring litter of pigs and carried through the season of 1921. The pork is credited at its market value at the close of each feeding period. Man-labor is charged at 36 cents per hour and horse-labor at 20.5 cents per hour. Rape was sown at last cultivation of corn but did not produce a stand.

FINANCIAL SUMMARY OF THE HOG WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Inventory March 1, 1920		Inventory February 28, 1921	
Equipment	$ 381.50	Equipment	$ 375.00
Livestock	835.00	Livestock	780.00
Expenses:		Supplies	5.00
Rent on 3½ acres	70.00	Receipts:	
Rent of 3 acres clover pasture	60.00	Livestock sold	1,558.01
Feed consumed	1,835.13	Estimated labor for experimental work	50.00
Man-hours 800 at 43c	344.00	To balance (loss)	966.40
Horse-hours 95 at 20c	19 00		
Tractor-hours 4.5 at $1.50	6.75		
Auto 91 miles at 8c	7 28		
Veterinary fees	76.75		
One boar purchased	75.00		
Water hose and connections	22.25		
Crude oil	1.75		
Totals	$3,734.41		$3,734.41

Note, the loss in 1920-21 is largely due to the high price of feed during the first half of the year and the low price of hogs when sold.

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Equipment	$ 375.00	Equipment	$ 660.00
Livestock	780.00	Livestock	875.00
Expenses:		Receipts:	
Equipment purchased	297.90	Livestock sold	1,557.30
Feed consumed	771.12	Boar services	8.00
Man-hours, 975 at 36c	351.00	Experimental labor	60.00
Horse-hours, 76.5 at 20c	15.30		
Tractor-hours, 6.5 at $1.50	9.75		
Auto mileage, 30 mi at 8c	2.40		
Auto & trailer, 50 mi. at 10c.	5.00		
Worm capsules	1.90		
Treating hogs	41.12		
Delivering hogs	5.00		
Crude oil	1.75		
Rent of land, 4 acres	70.00		
Rent of clover pasture, 3 A	60.00		
To balance (gain)	373.06		
Totals	$3,160.30		$3,160.30

Average prices: corn, 59c per cwt; tankage, $2.69 per cwt; oats, 90c per cwt; rye, $1.75 per cwt; middlings, $1.75 per cwt; soybeans, $2.05 per cwt; man labor, 36c per hour; horse labor, 20c per hour; average selling price of hogs, $7.65 per cwt.

PUBLIC INTEREST

The usual cooperative public spirit was evident throughout the year. The first public gatherings were held during the latter part of June as the wheat was ripening. At this time three consecutive days were given over to a demonstration of the farm's work. A large delegation of farmers from Auglaize County visited the farm June 21; followed by visitors from Champaign and Montgomery Counties the next day, and the regular Miami County Field Meeting on the twenty-third. A splendid interest in the work and a general appreciation of its importance to farmers were manifested.

The County Agent and Farm Bureau cooperated in the dissemination of the results of the different lines of the work. Frequent visitors at the farm; occasional press articles dealing with current phases in its operation; an exhibit at the annual county fair, and the distribution of farm literature, were further means of placing the farm at the public service.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

Five rotations are in progress on the Miami County Experiment Farm—namely:

Rotation I:	Corn, oats, wheat, clover.
Rotation II:	Corn, soybeans, wheat, clover.
Rotation III:	Corn, corn, oats, clover.
Rotation IV:	Tobacco, wheat, clover.
Rotation V:	Corn, wheat, clover.

In addition to these rotations alfalfa is being grown continuously.

Rotations I, II, and III were begun in 1911; Rotation IV was started in 1912, Rotation V in 1915, and Rotation VI in 1916. A 3-year rotation of potatoes, wheat, and clover was begun in 1916, but the potato yields were so unsatisfactory that none were planted in 1920 and 1921. All these rotations are so arranged that each crop is grown every season. The plan of fertilizing is shown in Table 3, and the crop yields for 1920 and 1921 and for the full period of the experiments are given in the tables following.

THE 4-YEAR CEREAL ROTATIONS

The soil of the Miami County Experiment Farm is typical of very large areas of land in western Ohio having a nearly flat topography; the soil of the slight elevations being a yellow clay loam, while the depressions between are black. When cultivated without attention to fertility maintenance the yellow land loses a considerable part of its already deficient humus and becomes still lighter in

color, while in the black land the losses due to cultivation are partially compensated by reinforcements from material washed in from the higher land. The consequence is that the yellow land shows fertility exhaustion much sooner than the black. Chemical analyses of the two types of soil indicate that the light-colored soil is low in phosphorus and that both soils are well supplied with calcium and magnesium. A test for carbonates, however, shows a deficiency in the light soil in this respect, amounting in some cases to actual acidity.

Fertilizers and manure on corn.—The tables show that acid phosphate has produced a decided increase in yield of corn, averaging, in the 4 rotations, more than 10 bushels of corn for 200 pounds of phosphate. Even at the lowest increase, 7 bushels, the phosphate has returned a very large profit in the corn crop alone.

The addition to the phosphate of 50 pounds of muriate of potash has added 3.7 bushels to the yield, or about one-seventh of a bushel of corn for each pound of potash given in the fertilizer, muriate of potash being one-half actual potash.

The further addition of nitrogen, in nitrate of soda, has not increased the yield over that produced by acid phosphate and muriate of potash combined, showing that the clover is thus far meeting the demands for nitrogen of the corn crops following.

The addition of ground limestone has added about a bushel and a half of corn to the yield produced by the same fertilizing without the limestone.

The manured land receives much larger quantities of the fertilizing elements than are given to any of the fertilized plots, and its yield is larger, though not proportionately so. The addition of acid phosphate to the manure has not as yet added enough to the increase to pay for the phosphate in these rotations, in which one of the other crops also receives acid phosphate.

Fertilizers and manure on oats.—In planning the fertilizing, the oats crop was given about half the quantities of fertilizers given to the corn, and no manure, the expectation being that the oats would profit by the residual effect of the treatment on the corn. The average increase of oats from acid phosphate has been 7.6 bushels per acre, which is 16 percent of the unfertilized yield, while the increase of corn in the 4-year rotation has been 22 percent of the unfertilized yield. The addition to the acid phosphate of 20 pounds of muriate of potash has raised the average yield of oats by 2.6 bushels, which would about cover the cost of the potash.

The further additions of nitrogen and limestone have not increased the yield.

The residual effect on oats of manure and fertilizers applied to previous crops is shown to be of considerable importance.

Fertilizers and manure on soybeans.—The soybean crop of 1919 was lost because of continuous rains at time of harvesting.

The unfertilized yield of soybeans for the 9 crops harvested in this experiment has averaged 21 bushels per acre, as against 47 bushels for oats and 12 to 14 bushels for wheat.

EFFECT OF PREVIOUS CROP ON YIELD OF WHEAT

Wheat after	No treatment	Acid phosphate	Acid phosphate Muriate potash	Acid phosphate Muriate potash Nitrate soda
	Bu.	*Bu.*	*Bu.*	*Bu.*
Corn	10.41	19.53	25.10	27.12
Oats	12.10	24.24	26.28	25.16
Soybeans	14.03	27.37	29.26	28.51
Tobacco	24.68	31.05	33.75	35.58

At these yields the soybean is decidedly more profitable than either oats or wheat, so long as the bushel of soybeans is worth as much as the bushel of wheat.

The soybeans seem to show a relatively smaller response to fertilizing than the cereal crops, but the quantity of fertilizer given to the soybeans has been much smaller than that given to wheat. The response to acid phosphate, however, has been profitable.

ANNUAL VALUES OF CROPS IN DIFFERENT ROTATIONS

Rotation	No treatment	Acid phosphate	Acid phosphate Muriate potash	Acid phosphate Muriate potash Nitrate soda
I Corn-oats-wheat-clover	$15.84	$21.32	$22.78	$22.22
II Corn-soys-wheat-clover	20.75	27.65	28.53	26.66
III Corn-corn-oats-clover	17.22	20.69	22.84	22.93
V Corn-wheat-clover	14.15	17.65	21.59	22.54
Average	$16.99	$21.83	$23.93	$23.59

Fertilizers and manure on wheat.—Wheat has followed oats, soybeans, and tobacco, each for 9 years, and corn for 6 years. The effect of each of these crops is shown by the actual total yields of wheat obtained from the different treatments in these rotations.

In the tobacco rotation the fertilizers are all applied to the tobacco crop. The land in this rotation, however, is all black land and is naturally more fertile than that in the other tests.

The annual average value per acre in the cereal rotations, computing corn at half a dollar a bushel, oats at one-third of a dollar, wheat at one dollar, soybeans at a dollar and a quarter, and hay at ten dollars a ton, are as follows:

At the valuations employed the soybean rotation is decidedly ahead. Not only is this crop valuable in itself but it apparently increases the yield of every crop in the rotation.

In the average of the 4 rotations the annual value of the produce of the unfertilized land has been $17.00 per acre. Acid phosphate, used at the rate of 500 pounds per acre for each 4-year period, or 125 pounds annually has increased the annual value to $21.83, a gain of $4.83 for 125 pounds of acid phosphate.

Muriate of potash, added to the acid phosphate at the rate of 90 pounds per acre for each 4-year period, or 22½ pounds annually, has raised the yield to $23.93, or $2.08 above that given by acid phosphate alone. If the muriate were purchased at the pre-war price of about 2¼ cents a pound this increase would barely cover its cost; but if bought at the rate at which potash is sold in mixed fertilizers, which is usually much greater than its cost in the muriate, there would be less clear gain from the fertilizer carrying potash than from the acid phosphate alone, notwithstanding the larger yield.

The further addition of nitrate of soda, in these rotations in which clover is systematically grown every fourth year, has produced no further increase in yield. In fact, in the soybean rotation the addition of the nitrate seems to have been a disadvantage. Since the cost of nitrogen in mixed fertilizer is always much greater than that in nitrate of soda, and since nitrate of soda is unquestionably the most effective carrier of nitrogen in fertilizers, it is evident that the Miami County farmer should rely upon the stable and the clover field for the maintenance of his nitrogen supply.

Fertilizers, manure, and limestone on alfalfa. In 1918 an experiment was begun in the continuous culture of alfalfa under different treatments. The results for the 4 years, 1918-1921 are given in Table 12, but they are too irregular to justify any definite conclusion. Apparently, lime and potassium are the most important additions to this soil for this crop.

PRACTICAL APPLICATIONS

The statistics of crop production in Miami County, as collected by the township assessors, show that during the 10 years, 1910-1919, the average acreage given to the principal crops was 55,000

acres for corn and 28,000 acres each to oats, wheat, and hay—about half the hay being clover—a total of about 140,000 acres. The proportion of clover to other crops was, therefore, approximately one acre of clover to 9 acres in the cereals and timothy, instead of one acre to three, including soybeans with the cereals, as grown in the 4-year rotations in these experiments.

During this period the livestock of the county should have produced during the 5 months of winter feeding each year about 100,000 tons of manure, which would have contained about 600,000 pounds of phosphoric acid. In addition to this manure, about 4,000 tons of commercial fertilizers were purchased annually. During recent years about half the fertilizers have been plain acid phosphate and about half have been mixed fertilizers. Assuming an average composition of 12 percent phosphoric acid, there has been an average purchase of about 1,000,000 pounds of phosphoric acid, making a total available supply of 1,600,000 pounds, or approximately 12 pounds per acre annually, if we assume that a part of the manure produced during the summer has been utilized.

In the experiments under review the average annual dressing has amounted to 125 pounds of 16-percent acid phosphate per acre, or 20 pounds of phosphoric acid. The average yields from this dressing have been 53.4 bushels of corn, 49 bushels of oats, and 23.7 bushels of wheat per acre; while the average yields for the county have been 41 bushels of corn, 38 bushels of oats, and 17 bushels of wheat. Discarding fractions and taking no account of the hay crops, which have been considerably larger in the experiments than for the county, there has been an increase of 12 bushels of corn, 11 bushels of oats, and 6 bushels of wheat for the additional 8 pounds of phosphoric acid given in these experiments. Applying these increases to the crop acreage of the county indicates the possibility of increasing by at least a quarter of a million dollars annually the total net earnings of the farms of Miami County, over and above the additional cost of treatment, by so arranging the crop rotation that at least half the corn shall be grown on clover sod, the clover area being increased by dropping out the timothy; by transferring most if not all the oats area to soybeans; by increasing the purchase of acid phosphate to about twice the quantity of all fertilizers now used; by discarding the mixed fertilizers; and by such care in the preservation and distribution of the manure produced as to realize its full value as a carrier of both phosphoric acid and potash.

TABLE 3.—PLAN OF FERTILIZING, MIAMI COUNTY EXPERIMENT FARM

Pounds of fertilizing materials per acre for each crop

Rotation I: Corn-oats-wheat-clover

Plot	On corn				On oats			On wheat		
	Acid phosphate	Muriate potash	Nitrate soda	Ground limestone	Acid phosphate	Muriate potash	Nitrate soda	Acid phosphate	Muriate potash	Nitrate soda
1										
2	200				100			200		
3	200	50			100	20		200	20	
4										
5	200	50	50		100	20	30	200	20	80
6	200	50	50	*4,000	100	20	30	200	20	80
7										
8	Manure, 8 tons							200	50	50
9	Manure, 8 tons, phosphated†							200	50	50
10										

Rotation II: Corn-soybeans-wheat-clover

	On corn				On soybeans			On wheat		
1										
2	200				100			200		
3	200	50			100	20		200	20	
4										
5	200	50	50		100	20	30	200	20	80
6	130	50	20		70	20	10	160	20	20
7										
8	160	20	20		100			170		30
9	160	20	20	‡	100			170		30
10										

Rotation III: Corn-corn-oats-clover

	On corn 1st				On corn 2d			On oats		
1										
2	200				200			100		
3	200	50			200	20		100	20	
4										
5	200	50	50		200	20	80	100	20	30
6	200	50	50	*4,000	200	20	80	100	20	30
7										
8	Manure, 8 tons				200	50	50			
9	Manure, 8 tons, phosphated†				200	50	50			
10										

Rotation IV: Tobacco-wheat-clover (Fertilizers all on tobacco)					Rotation V: Corn-wheat-clover					
					On corn			On wheat		
1										
2	480				200			200		
3	480	180			200	50		200	20	
4										
5	480	180	240		200	50	50	200	20	80
6	480	180	240	2,000	200	50	50§	200	20	80
7										
8	240	90	120		Manure, 8 tons			200	50	50
9	Manure, 10 tons, phosphated†				Manure, 8 tons, phos.†			200	50	50
10										

*2,000 pounds in 1912. †40 pounds acid phosphate per ton of manure. ‡Catch crop to follow corn. §4,000 pounds limestone in addition.

TABLE 4, PART I.—Fertilizers and manure on CORN, Miami County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre on corn	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot No.
	Rotation I: Corn-oats-wheat-clover	Block C				Block D				11-year average				
1	None	64.29	2,850			24.29	1,300			42.21	2,130			1
2	Acid phosphate, 200 lb	72.86	3,400	10.24	617	34.29	1,600	4.76	217	55.75	2,551	11.88	388	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	76.43	3,500	15.47	783	54.29	1,950	19.53	483	61.64	2,798	16.11	601	3
4	None	59.29	2,650			40.00	1,550			47.18	2,230			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb	72.86	3,450	15.95	867	54.29	2,050	12.86	383	59.08	2,688	12.14	438	5
6	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.; ground limestone, 2 tons	76.43	3,650	21.91	1,133	55.71	2,150	12.85	367	59.47	2,780	12.77	510	6
7	None	52.14	2,450			44.29	1,900			46.46	2,290			7
8	Untreated manure, 8 tons	68.57	3,350	23.81	1,100	72.86	2,850	19.05	633	64.25	2,931	15.44	529	8
9	Phosphated manure, 8 tons	77.14	3,300	39.76	1,250	77.14	3,500	13.80	967	70.37	3,405	19.21	890	9
10	None	30.00	1,850			72.86	2,850			53.52	2,627			10
	Average unfertilized yield	51.43	2,450			45.36	1,900			47.34	2,319			
	Average fertilized yield	74.05	3,442			58.10	2,350			61.76	2,859			
	Rotation II: Corn-soybeans-wheat-clover	Block H				Block E				11-year average				
1	None	70.00	3,400			72.86	3,400			61.99	2,798			1
2	Acid phosphate, 200 lb	75.00	3,650	7.62	400	73.57	3,500	4.04	250	67.58	3,037	6.98	278	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	79.29	3,500	14.53	400	75.71	3,350	9.52	250	70.38	3,085	11.16	365	3
4	None	62.14	2,950			62.86	2,950			57.84	2,681			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb	72.86	3,500	11.67	617	70.00	3,100	8.09	300	64.62	2,962	7.84	331	5
6	Acid phos., 130 lb.; mur. pot., 50 lb.; nitrate soda, 20 lb	70.00	3,500	9.76	683	70.00	3,300	9.05	650	63.47	2,851	7.76	270	6
7	None	59.29	2,750			60.00	2,500			54.65	2,531			7
8	Acid phos., 160 lb.; mur. pot., 20 lb.; nitrate soda, 20 lb	72.14	3,400	14.99	550	63.57	2,950	8.81	633	62.90	2,854	9.55	355	8
9	Acid phos., 160 lb.; mur. pot., 20 lb.; nitrate soda, 20 lb	70.71	3,500	15.71	550	65.71	2,750	16.18	617	60.78	2,828	8.72	362	9
10	None	52.86	3,050			44.29	1,950			50.76	2,434			10
	Average unfertilized yield	61.07	3,037			60.00	2,700			56.31	2,611			
	Average fertilized yield	73.33	3,508			69.76	3,158			64.95	2,936			

*40 pounds acid phosphate per ton of manure. †Catch crop to follow corn.

TABLE 4, PART II.—Fertilizers and manure on CORN, Miami County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre on corn	1920 Yield		1920 Increase		1921 Yield		1921 Increase		Average Yield		Average Increase		Plot No.
		Grain Bu.	Stover Lb.	Grain Bu.	Stover Lb.	Grain Bu.	Stover Lb.	Grain Bu.	Stover Lb.	Grain Bu.	Stover Lb.	Grain Bu.	Stover Lb.	
	Rotation III: Corn-corn-oats-clover: Corn first crop	Block M				Block I				11-year average				
1	None	36.43	2,200	.....	.....	39.29	1,650	.....	.....	40.27	2,074	.....	.....	1
2	Acid phosphate, 200 lb	64.29	2,800	25.72	550	45.71	2,000	4.28	233	53.28	2,533	11.01	374	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	67.14	2,750	26.42	450	53.57	2,000	10.00	117	58.12	2,663	13.85	418	3
4	None	42.86	2,350	.....	.....	45.71	2,000	.....	.....	46.26	2,330	.....	.....	4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	67.14	2,850	19.52	500	61.43	2,400	13.34	250	59.15	2,668	13.36	351	5
6	Acid phos., 200 lb.: mur. pot., 50 lb.; nitrate soda, 50 lb.; ground limestone, 2 tons	75.71	3,400	23.33	1,050	68.57	2,650	18.09	350	61.58	2,689	16.27	386	6
7	None	57.14	2,350	.....	.....	52.86	2,450	.....	.....	44.84	2,290	.....	.....	7
8	Untreated manure, 8 tons	75.71	3,650	18.81	1,300	75.00	3,250	19.28	833	66.04	2,997	19.94	717	8
9	Phosphated manure, 8 tons	77.84	3,200	21.19	850	72.86	3,200	14.29	817	67.43	2,998	20.05	728	9
10	None	56.43	2,350	.....	.....	61.43	2,350	.....	.....	48.65	2,260	.....	.....	10
	Average unfertilized yield	48.21	2,312	.....	.....	49.82	2,112	.....	.....	45.00	2,239	.....	.....	
	Average fertilized yield	71.30	3,108	.....	.....	62.86	2,583	.....	.....	60.93	2,758	.....	.....	
	Rotation III: Corn-corn-oats-clover: Corn second crop	Block L				Block M				11-year average				
1	None	30.71	1,600	.....	.....	28.57	1,450	.....	.....	31.06	1,732	.....	.....	1
2	Acid phosphate, 200 lb	58.57	2,400	19.05	550	47.14	1,950	13.57	433	47.20	2,207	12.10	364	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	69.29	3,100	20.96	1,000	57.86	2,150	19.29	567	54.77	2,445	15.64	490	3
4	None	57.14	2,350	.....	.....	43.57	1,650	.....	.....	43.17	2,066	.....	.....	4
5	Acid phos., 200 lb.; mur. pot. 20 lb.; nitrate soda, 80 lb.	70.71	2,950	16.90	667	57.86	2,400	11.19	567	56.62	2,525	13.85	447	5
6	Acid phos., 200 lb.; mur. pot. 20 lb.; nitrate soda, 80 lb.	72.86	3,000	22.39	783	69.29	2,450	9.53	433	56.74	2,619	14.37	528	6
7	None	47.14	2,150	.....	.....	52.86	2,200	.....	.....	41.97	2,103	.....	.....	7
8	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	70.00	2,850	26.91	817	66.43	2,750	10.95	483	61.48	2,870	19.35	708	8
9	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	72.86	3,050	33.81	1,133	69.29	3,050	11.20	717	62.55	2,988	20.26	768	9
10	None	35.00	1,800	.....	.....	60.71	2,400	.....	.....	42.45	2,278	.....	.....	10
	Average unfertilized yield	42.50	1,975	.....	.....	46.43	1,925	.....	.....	39.67	2,045	.....	.....	
	Average fertilized yield	69.05	2,892	.....	.....	59.64	2,458	.....	.....	56.56	2,609	.....	.....	

TABLE 5.—Fertilizers and manure on OATS, Miami County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre on oats	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
	Rotation I: Corn-oats-wheat-clover	Block B				Block C				10-year average				
1	None	43.44	2,460			29.06	1,720			42.41	2,406			1
2	Acid phosphate, 100 lb	51.25	2,510	4.06	203	31.25	1,900	2.19	230	50.94	2,715	6.62	330	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	62.81	2,590	11.87	437	30.31	1,980	1.25	360	55.70	2,890	9.45	527	3
4	None	54.69	2,000			29.06	1,570			48.17	2,341			4
5	Acid phos., 100 lb.; mur. pot., 20 lb.; nit. soda, 30 lb.	64.37	2,140	12.29	290	35.00	1,930	6.98	410	58.29	2,668	10.66	354	5
6	Acid phos., 100 lb.; mur. pot., 20 lb.; nit. soda, 30 lb.*	63.12	1,930	13.64	230	32.81	1,750	5.83	280	57.97	2,725	10.88	439	6
7	None	46.87	1,550			25.94	1,420			46.55	2,258			7
8	Untreated manure on corn	55.31	2,230	5.31	347	31.87	1,530	6.87	247	53.85	2,638	6.53	336	8
9	Phosphated manure on corn	59.06	2,610	5.94	393	32.81	1,750	8.75	603	55.82	3,054	7.72	707	9
10	None	56.25	2,550			23.12	1,010			48.87	2,391			10
	Average unfertilized yield	50.31	2,140			26.80	1,430			46.50	2,349			
	Average fertilized yield	59.32	2 335			32.34	1,807			55.43	2,782			
	Rotation III: Corn-corn-oats-clover	Block K				Block L				10-year average				
1	None	40.94	1,940			23.44	1,100			43.73	2,005			1
2	Acid phosphate, 100 lb	47.81	2,570	4.48	540	32.19	1,520	6.04	207	54.31	2,538	8.69	334	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	55.94	2,460	10.21	340	37.50	2,100	8.65	573	58.58	2,900	11.06	496	3
4	None	48.12	2,210			31.56	1,740			49.40	2,601			4
5	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.	64.69	2,430	16.88	327	33.44	1,980	3.65	367	58.89	2,890	9.85	377	5
6	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.*	64.06	2,500	16.56	503	30.94	1,510	2.92	23	58.19	2,890	9.51	465	6
7	None	47.19	1,890			26.25	1,360			48.31	2,336			7
8	Untreated manure on corn	57.19	2,420	11.03	597	29.06	1,620	4.27	363	55.74	2,907	7.75	586	8
9	Phosphated manure on corn	62.19	2,360	17.07	603	29.69	1,650	6.36	497	56.66	3,061	9.00	755	9
10	None	44.09	1,690			21.87	1,050			47.35	2 290			10
	Average unfertilized yield	45.08	1,932			25.78	1,312			47.20	2,308			
	Average fertilized yield	58.65	2,457			32.14	1,730			57.06	2,864			

*Ground limestone on corn.

TABLE 6.—Fertilizers and manure on SOYBEANS, Miami County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre on soybeans	1920				1921				Average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Beans	Straw	Beans	Straw	Beans	Straw	Beans	Straw	Beans	Straw	Beans	Straw	
	Rotation II: Corn-soybeans-wheat-clover	Block G				Block H				9-year average				
No.		*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*No.*
1	None	18.17	1,160	.....	.....	25.50	1,870	.....	.....	23.44	2,206	.....	.....	1
2	Acid phosphate, 100 lb.	19.58	1,475	.19	288	27.33	2,010	2.55	180	24.99	2,507	1.92	392	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb.	20.17	1,290	—.44	77	27.83	1,930	3.78	140	25.29	2,329	2.58	305	3
4	None	21.83	1,240	.....	.....	23.33	1,750	.....	.....	22.34	1,934	.....	.....	4
5	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.	22.50	1,700	.36	445	23.33	1,650	.83	0	23.33	2,288	1.59	417	5
6	Acid phos., 70 lb.; mur. potash, 20 lb.; nitrate soda, 10 lb.	26.00	1,790	3.56	520	22.00	1,480	.34	—70	22.08	1,983	.95	174	6
7	None	22.75	1,285	.....	.....	20.83	1,450	.....	.....	20.54	1,747	.....	.....	7
8	Acid phosphate, 100 lb.	21.50	1,660	—1.33	363	25.50	1,920	5.61	547	22.58	1,981	2.58	325	8
9	Acid phosphate, 100 lb.	24.33	1,640	1.41	332	23.67	1,880	4.73	583	21.59	1,953	2.12	388	9
10	None	23.00	1 320	.....	.....	18.00	1 220	.....	.....	18.94	1,475	.....	.....	10
	Average unfertilized yield	21.44	1,250	.....	.....	21.91	1,572	.....	.....	21.31	1,840	.....	.....	
	Average fertilized yield	22.35	1,592	.....	.....	24.94	1 812	.....	.....	23.31	2 173	.....	.....	

TABLE 7.—Fertilizers and manure on WHEAT, following oats or soybeans, Miami County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre on wheat	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
	Rotation I: Corn-oats-wheat-clover	Block A				Block B				9-year average				
1	None	3.42	445			19.71	2,000			12.38	1,566			1
2	Acid phosphate, 200 lb.	18.00	1,720	13.97	1,195	26.67	3,050	9.33	1,223	24.24	2,607	12.64	1,148	2
3	Acid phosphate, 200 lb., muriate of potash, 20 lb.	21.42	1,665	16.78	1,060	31.17	3,680	15.67	2,027	26.28	2,695	15.46	1,343	3
4	None	5.25	685			13.67	1,480			10.04	1,245			4
5	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 80 lb.	25.00	1,950	15.44	1,090	25.50	3,070	13.72	1,777	25.16	2,718	15.04	1,475	5
6	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 80 lb.*	25.83	2,000	11.97	965	21.00	2,040	11.11	933	26.20	2,767	16.00	1,526	6
7	None	18.17	1,210			8.00	920			10.29	1,239			7
8	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb†	33.92	3,265	14.97	1,918	19.83	1,960	9.22	847	27.17	2,962	15.07	1,513	8
9	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb‡	38.00	3,270	18.28	1,787	26.00	2,840	12.78	1,533	29.08	3,183	15.19	1,524	9
10	None	20.50	1,620			15.83	1,500			15.70	1,869			10
	Average unfertilized yield	11.83	990			14.17	1,475			12.10	1,479			
	Average fertilized yield	27.03	2,312			25.03	2,773			26.35	2,822			
	Rotation II: Corn-soybeans-wheat-clover	Block F				Block G				9-year average				
1	None	10.83	1,050			17.67	1,840			17.73	1,972			1
2	Acid phosphate, 200 lb.	27.33	2,710	15.42	1,592	26.83	2,390	9.72	533	27.37	2,861	10.81	977	2
3	Acid phosphate, 200 lb.; muriate of potash, 20 lb.	35.33	2,830	22.33	1,643	29.00	3,210	12.44	1,337	29.26	3,061	13.87	1,265	3
4	None	14.08	1,255			16.00	1,890			14.21	1,708			4
5	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 80 lb.	32.58	2,495	19.80	1,328	26.67	3,100	11.45	1,330	28.51	3,066	14.89	1,387	5
6	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 20 lb.	29.67	2,270	18.20	1,192	24.33	2,290	9.88	640	25.89	2,710	12.86	1,062	6
7	None	10.17	990			13.67	1,530			12.44	1,618			7
8	Acid phosphate, 170 lb.; nitrate soda, 30	27.17	2,170	15.00	1,067	23.00	2,420	10.05	1,113	24.64	2,611	12.43	1,070	8
9	Acid phosphate, 170 lb.; nitrate soda, 30§	31.67	2,650	17.50	1,433	21.83	2,390	9.61	1,307	24.90	2,560	12.92	1,095	9
10	None	16.17	1,330			11.50	860			11.76	1,388			10
	Average unfertilized yield	12.81	1,156			14.71	1,530			14.02	1,672			
	Average fertilized yield	30.62	2,521			25.28	2,800			26.76	2,811			

*Ground limestone on corn. †Untreated manure on corn. ‡Phosphated manure on corn. §Catch crop to follow corn.

TABLE 8.—Fertilizers and manure on CORN and WHEAT in corn-wheat-clover rotation, Miami County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield		1920 Increase		1921 Yield		1921 Increase		Average Yield		Average Increase		Plot No.
		Grain Bu.	Stover Straw Lb.	Grain Bu.	Stover Straw Lb.	Grain Bu.	Stover Straw Lb.	Grain Bu.	Stover Straw Lb.	Grain Bu.	Stover Straw Lb.	Grain Bu.	Stover Straw Lb.	
	Rotation V: Corn	Block S				Block Q				7-year average				
1	None	47.86	1,900			42.14	1,500			43.34	1,862			1
2	Acid phosphate, 200 lb.	49.29	1,700	1.67	—183	42.14	1,500	—.95	—67	43.47	1,834	—1.00	—45	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb.	56.43	1,900	9.05	33	57.86	2,200	13.81	567	54.99	2,213	9.39	317	3
4	None	47.14	1,850			45.00	1,700			46.73	1,913			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	57.14	1 900	10.95	150	62.14	2 200	17.14	533	54.85	2,131	8.20	218	5
6	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.; ground limestone, 2 tons	62.14	2,400	16.90	750	64.29	2,250	19.29	617	55.67	2,240	9.10	328	6
7	None	44.29	1,550			45.00	1,600			46.49	1,912			7
8	Untreated manure, 8 tons	65.71	2,000	23.56	400	65.71	2,600	20.47	1,000	59.06	2,407	13.91	496	8
9	Phosphated manure, 8 tons*	63.59	2,150	23.59	500	66.43	2,350	20.96	750	60.37	2,491	16.57	581	9
10	None	37.86	1,700			45.71	1,600			42.46	1,909			10
	Average unfertilized yield	44.29	1,750			44.46	1,600			44.75	1,899			
	Average fertilized yield	59.05	2,408			59.76	2,163			54.73	2,219			
	Rotation V: Wheat	Block R				Block S				6-year average				
1	None	10.25	985			8.17	1,260			9.37	1,460			1
2	Acid phosphate, 200 lb.	24.42	2,285	12.31	1,112	14.50	1,730	6.72	563	19.53	2,220	10.09	771	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb.	32.17	2,570	18.20	1,208	17.67	1,940	10.28	867	25.10	2,619	15.60	1,181	3
4	None	15.83	1,550			7.00	980			9.55	1,427			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	36.50	2,860	19.17	1,250	17.17	2,270	10.28	1,250	27.12	2,956	16.81	1,440	5
6	Acid phos., 400 lb.; mur. pot., 100 lb.; nitrate soda, 100 lb.	33.58	2,335	14.75	665	17.67	1,890	10.89	830	26.83	2,740	15.76	1,135	6
7	None	20.33	1,730			6.67	1,100			11.83	1,694			7
8	Untreated manure, 8 tons	32.50	2,600	14.53	1,062	20.17	2,290	13.17	1,227	28.37	3,068	16.86	1,431	8
9	Phosphated manure, 8 tons*	30.17	2,440	14.56	1,093	21.67	2,600	14.33	1,573	29.64	3,247	18.44	1,667	9
10	None	13.25	1,155			7.67	990			10.88	1,522			10
	Average unfertilized yield	14.91	1,355			7.37	1,082			10.41	1,526			
	Average fertilized yield	31.56	2,515			18.14	2,287			26.09	2,808			

*Acid phosphate, 40 pounds per ton of manure.

TABLE 9.—Fertilizers and manure on WHEAT following tobacco or potatoes, Miami County Experiment Farm

Plot No.	Fertilizers per acre on wheat*	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
	Rotation IV: Tobacco-wheat-clover	Block O				Block P				9-year average				
1	None	23.00	2,820			9.67	1,220			21.86	2,771			1
2	Acid phosphate, 480 lb.	35.00	3,900	6.00	573	22.33	3,060	9.99	1,533	31.05	3,212	6.57	353	2
3	Acid phosphate, 480 lb.; muriate potash, 180 lb.	40.00	3,900	5.00	67	26.00	2,840	11.00	1,007	33.75	3,553	6.66	606	3
4	None	41.00	4,340			17.67	2,140			29.71	3,035			4
5	Acid phos., 480 lb.; mur. pot., 180 lb.; nitrate soda, 240 lb.	42.17	4,270	3.39	297	31.00	3,940	12.89	1,693	35.58	3,788	7.69	861	5
6	Acid phos., 480 lb.; mur. pot., 180 lb.; nitrate soda, 240 lb. ground limestone, 1 ton	42.83	4,530	6.28	923	31.67	4,100	13.11	1,747	34.64	3,668	8.57	848	6
7	None	34.33	3,240			19.00	2,460			24.24	2,713			7
8	Acid phos., 240 lb.; mur. pot., 90 lb.; nitrate soda, 120 lb.	38.33	3,400	9.44	600	28.33	3,200	7.22	467	27.39	2,631	3.59	—25	8
9	Acid phos., 400 lb.; stable manure, 10 tons	40.33	3,980	16.89	1,620	35.67	4,660	12.45	1,653	32.57	3,561	9.23	964	9
10	None	18.00	1,920			25.33	3,280			22.90	2,539			10
	Average unfertilized yield	29.08	3,080			17.92	2,275			24.68	2,765			
	Average fertilized yield	39.78	3,997			29.17	3,633			32.50	3,402			
	Rotation VI: Potatoes-wheat-clover	Block U				Block T†				5-year average				
1	None	31.24	2,840							24.03	2,859			1
2	Acid phosphate, 200 lb	39.67	3,140	7.15	282					31.51	3,503	8.64	674	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	45.04	3,391	11.25	475					33.08	3,558	11.37	759	3
4	None	35.07	2,955							20.54	2,769			4
5	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 80 lb.	46.57	4,105	11.88	1,127					34.19	3,951	13.61	1,169	5
6	Acid phosphate, 200 lb.; muriate potash, 20 lb	46.96	4,312	12.66	1,310					34.27	3,935	13.65	1,140	6
7	None	33.92	3,025							20.66	2,808			7
8	Acid phosphate, 400 lb. (manure on potatoes)	45.81	4,266	15.59	1,556					34.15	3,930	14.63	1,246	8
9	Acid phosphate, 400 lb. (manure on potatoes)	41.40	4,071	14.89	1,675					31.81	3,979	13.43	1,418	9
10	None	22.81	2,081							17.25	2,438			10
	Average unfertilized yield	30.76	2,725							20.62	2,719			
	Average fertilized yield	44.24	3,881							33.17	3,809			

*In the tobacco rotation the fertilizers are all applied to the tobacco. †In the potato rotation no potatoes were harvested in 1920 nor in 1921, and no wheat in 1921.

TABLE 10, PART I.—Residual effect on CLOVER of fertilizing materials applied to previous crops of rotation, Miami County Experiment Farm
Pounds per acre

Plot No.	Fertilizing materials on previous crop					Yield and increase					
						1920		1921		Average	
	Acid phosphate	Muriate potash	Nitrate soda	Ground limestone	Manure	Yield	Increase	Yield	Increase	Yield	Increase
Rotation I: Corn-oats-wheat-clover						Block D		Block A		8-year average	
1						1,095		1,137		2,632	
2	500					2,568	1,305	2,653	1,446	3,237	746
3	500	90				2,527	1,095	2,611	1,334	3,092	744
4						1,600		1,347		2,206	
5	500	90	160			2,737	997	2,821	1,249	2,949	712
6	500	90	160	2 tons		3,621	1,740	2,947	1,151	3,364	1,097
7						2,021		2,021		2,298	
8	200	50	50		8 tons	3,284	870	2,526	687	3,045	676
9	520*	50	50		8 tons	4,126	1,319	2,526	870	3,490	1,049
10						3,200		1,474		2,513	
Average unfertilized yield						1,979		1,495		2,412	
Average fertilized yield						3,144		2,681		3,196	
Rotation II: Corn-soybeans-wheat-clover						Block E		Block F		8-year average	
1						3,453		1,389		2,873	
2	500					3,621	477	2,737	1,123	3,640	780
3	500	90				3,663	828	2,905	1,067	3,615	768
4						2,526		2,063		2,834	
5	500	90	160			2,779	253	3,116	1,221	3,330	518
6	360	90	50			3,242	716	2,779	1,053	3,216	427
7						2,526		1,558		2,767	
8	430	20	50			3,411	829	2,779	1,011	3,384	578
9	430	20	50			3,537	898	3,074	1,095	3,586	740
10						2,695		2,189		2,886	
Average unfertilized yield						2,800		1,800		2,840	
Average fertilized yield						3,375		2,898		3,462	
Rotation III: Corn-corn-oats-clover						Block J		Block K		8-year average	
1						2,779		842		2 062	
2	500					3,916	1,193	1,263	365	2,884	804
3	500	90				4,084	1,417	1,347	392	3,081	984
4						2,611		1,011		2,116	
5	500	90	160			4,126	1,459	1,179	196	2,845	726
6	500	90	160	2 tons		4,211	1,488	1,558	604	3,144	1,024
7						2,779		926		2,123	
8	200	50	50		8 tons	4,505	1,305	1,684	940	3,231	1,031
9	520*	50	50		8 tons	5,305	1,684	1,684	1,123	3,567	1,292
10						4,042		379		2,351	
Average unfertilized yield						3,053		789		2,163	
Average fertilized yield						4,358		1,453		3,125	

*320 lb. in "phosphated" manure and 200 lb. on wheat.

TABLE 10, PART II.—Residual effect on CLOVER of fertilizing materials applied to previous crops of rotation, Miami County Experiment Farm
Pounds per acre

Plot No.	Acid phosphate Lb.	Muriate potash Lb.	Nitrate soda Lb.	Ground limestone Tons	Manure Tons	1920 Yield Lb.	1920 Increase Lb.	1921 Yield Lb.	1921 Increase Lb.	Average Yield Lb.	Average Increase Lb.
Rotation IV: Tobacco-wheat-clover						Block N		Block O		8-year average	
1						3,790		3,032		4,526	
2	480					2,610	—1,096	3,874	702	5,385	832
3	480	180				3,705	84	3,958	645	5,483	902
4						3,537		3,453		4,609	
5	480	180	240			3,368	—197	3,116	—140	5,022	531
6	480	180	240	1		3,368	—225	2,611	—449	4,743	370
7						3,621		2,863		4,254	
8	240	90	120			3,032	—561	3,705	1,123	4,608	298
9	400				10	3,874	309	3,453	1,151	5,151	785
10						3,537		2,021		4,422	
Average unfertilized yield						3,621		2,842		4,453	
Average fertilized yield						3,326		3 453		5,065	
Rotation V: Corn-wheat-clover						Block Q		Block R		5-year average	
1						1,600		674		1,869	
2	400					2,316	983	1,895	898	2,341	486
3	400	70				2,568	1,501	2,105	786	2,434	592
4						800		1,642		1,827	
5	400	70	130			2,526	1,642	2,147	463	2,619	724
6	400	70	130	2		2,989	2,020	2,032	307	2,705	743
7						1,053		1,767		2,029	
8					8	2,232	1,179	2,695	956	2,771	744
9	*				8	3,016	1,963	3,200	1,488	3,197	1,172
10						1,053		1,684		2,022	
Average unfertilized yield						1,126		1,442		1,937	
Average fertilized yield						2,598		2,346		2,678	

TABLE 11.—Fertilizers and manure on TOBACCO, Miami County Experiment Farm. Yield and increase in pounds per acre

Plot No.	Acid phosphate	Muriate potash	Nitrate soda	Ground limestone	Manure	1920 Yield	1920 Increase	1921 Yield	1921 Increase	Average Yield	Average Increase
Rotation IV: Tobacco-wheat-clover						Block P		Block N		10-year average	
1						290		1,440		1,033	
2	480					810	433	1,460	23	1,289	197
3	480	180				1,080	617	1,760	327	1,486	318
4						550		1,430		1,209	
5	480	180	240			1,110	563	1,580	247	1,486	363
6	480	180	240	1		1 110	567	1,680	443	1,425	387
7						540		1,140		953	
8	240	90	120			910	390	1,330	257	1,178	270
9	400				10	1,200	700	1,320	313	1,224	362
10						480		940		816	
Average unfertilized yield						465		1,237		1,004	
Average fertilized yield						1,037		1 522		1,345	

*320 pounds mixed with manure, "phosphated manure."

TABLE 12.—Fertilizers, manure, and limestone on ALFALFA, grown continuously, Miami County Experiment Farm

Plot No.	Treatment in pounds per acre				Yield and increase in pounds per acre										Plot No.
					1918		1919		1920		1921		4-year average		
	Acid phosphate	Muriate potash	Ground limestone	Manure (Tons)	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	
1	.....	.....	4,000	.....	7,537	1,263	2,931	108	7,832	674	4,968	421	5,817	616	1
2	.....	.....	.....	.....	6,274	.....	2,823	.....	7,158	.....	4,547	.....	5,200	.....	2
3	300	.....	4,000	10	9,389	2,961	3,116	223	8,210	1,236	5,263	800	6,494	1,305	3
4	300	.....	.....	10	8,000	1,417	3,032	70	7,326	533	5,684	1,305	6,010	831	4
5	.....	.....	.....	.....	6,737	.....	3,032	.....	6,610	.....	4,295	.....	5,168	.....	5
6	.....	.....	.....	10	8,452	1,855	2,695	—309	6,653	43	3,705	—450	5,376	285	6
7	300	100	4,000	.....	7,663	1,207	3,537	562	6,737	127	4,463	449	5,600	586	7
8	.....	.....	.....	.....	6,316	.....	2,947	.....	6,610	.....	3,874	.....	4,937	.....	8
9	300	100	.....	.....	8,716	2,119	3,621	576	8,084	1,151	4,716	603	6,284	1,112	9
10	600	.....	.....	.....	8,379	1,502	2,989	—155	7,242	—14	4,337	—14	5,737	330	10
11	.....	.....	.....	.....	7,158	.....	3,242	.....	7,579	.....	4,590	.....	5,642	.....	11
12	300	.....	.....	.....	7,244	86	2,358	—884	5,853	—1,726	4,253	—337	4,927	—715	12
Average unfertilized yield					6,614	.....	3,011	.....	6,989	.....	4,327	.....	5,237	.....	
Average fertilized yield					8,172	.....	3,035	.....	7,242	.....	4,673	.....	5,780	.....	

1918, 3 cuttings; 1919, 2 cuttings; 1920, 3 cuttings; 1921, 2 cuttings.

VARIETY COMPARISONS

DEPARTMENT OF AGRONOMY

CORN

Table 13 gives the yield of 9 varieties of corn grown in the test at the Miami County Experiment Farm. The average yield of all varieties is reported for a 9-year period, except Boone County White which is for 8 years and Connor's Prolific for 6 years. The yields of ear corn are given for 1920 and 1921.

TABLE 13.—VARIETIES OF CORN, YIELD PER ACRE

Variety	1920	1921	9-year average*	
			Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Lb.*
Leaming	57.36	42.11	55.22	2,250
Clarage	62.30	45.25	56.30	2,178
White Cap	57.83	44.68	55.11	2,449
Cook's 75	69.50	46.96	60.72	2,701
Ried (Orcutt)	60.11	57.10	60.75	2,780
Ohio 84	61.64	43.11	52.98	2,262
Boone County White	64.88	58.39	65.23	3,790†
Darke County Mammoth	70.78	53.25	63.62	2,698
Connors Prolific	66.20	45.54	53.70	3,373‡

*The yield of corn, oats, wheat, and soybeans for the individual years prior to 1920 are given in Bulletin No. 344, part 1. †8 years. ‡6 years.

In comparing the varieties it should be noted that Leaming, Clarage, White Cap, and Ohio 84 make up a group of rather early-maturing sorts of which Clarage is the highest yielder and Leaming the second. Cooks' 75 (a strain of Reid's), Reid's (Orcutt), and Darke County Mammoth make up a somewhat later group in which Darke County Mammoth leads with the other two sorts practically a tie. Of the latest sorts, Boone County White leads. On the whole, the later maturing sorts have the larger yields of ear corn at husking time but also carry a larger percentage of water, which should be taken into consideration in comparing the several varieties.

The stover yields of the varieties are directly comparable. Boone County White yields the highest in stover, Conner's Prolific second, and Reid's (Orcutt) third.

OATS, BARLEY, AND SPRING WHEAT

The average yields of oats, barley, and spring wheat are given in Table 14 for a 10-year period except where noted in the table. In comparing the yields it should be remembered that a bushel of oats or emmer weighs 32 pounds, barley 48 pounds, and spring wheat 60 pounds. On this basis the barley yielded 437 pounds per acre less than the best variety of oats.

The variety of oats formerly known as Ohio 6203 has been named "Miami" in honor of the county. It has been the best yielder of any variety tested for a 10-year period.

WHEAT

Fifteen varieties of wheat have been tested for a 9-year period, with a few exceptions noted in the table. Gladden is first in yield

TABLE 14.—VARIETIES OF OATS AND OTHER SPRING CEREALS, YIELD PER ACRE

Varieties	1920	1921	10-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Big Four	72.58	33.36	61.16	2,479
Silver Mine	67.66	36.25	59.22	2,511
Swedish Select	61.57	33.76	56.60	2,326
Ohio 7009	51.56	37.49	55.93	1,673
Miami (Ohio 6203)	66.48	35.70	64.03	2,161
Ohio 6222	64.85	28.91	59.60	2,573
Wideawake	62.19	35.31	56.04	2,747
Oderbrucker Barley	25.83	27.29	33.79	1,960
Albion (Iowa 103)	46.72	.....	55.61	1,748*
Emmer	.....	.....	36.07	2,346†
Spring wheat-Blue Ribbon	12.67	5.50	11.46	1,687*
Fulghum	.....	38.12	.....	1,680‡

*4 years. †5 years. ‡1 year.

with an average of 35.08 bushels per acre; followed by Gypsy, second; Trumbull, third; Valley, fourth; and Portage, fifth.

The average yields of wheat on the Miami farm have been among the highest of the county and district experiment farms of

TABLE 15.—VARIETIES OF WHEAT, YIELD PER ACRE

Varieties	1920	1921	9-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Fultz	31.67	25.73	29.31	3,875
Trumbull	32.57	34.14	33.31	3,539
Ohio 8106	33.73	32.52*	30.61	3,684
Poole	27.79	31.18	30.23	3,780
Portage	34.95	29.40	32.05	3,637
Gypsy	32.40	34.18	33.62	4,271
Gladden	33.50	36.07	35.08	4,609
Mediterranean	.....	.....	31.18	3,752†
Rudy	34.62	35.29	31.91	3,312
Turkey Red	29.54	26.18	29.10	3,429
Valley	31.62	29.63	32.27	3,765
Goens	32.62	23.90	30.58	3,359
Nigger	34.87	33.12	31.50	3,317
Velvet Chaff	31.12	26.29	29.97	3,655
Ohio 9920	29.76	28.46	30.11	2,993‡

*A different selection of Fultz (8090) was used in 1921. †7 years. ‡6 years.

the State. The yield of wheat in the county as a whole is above the State average and the results obtained on this farm indicate that Miami County might easily rank among the leading wheat-producing counties of the State.

The best date for seeding wheat in Miami County as indicated by the 7-year test given in Table 16 was September 29. A week later was somewhat better than a week earlier. In the 7-year period September 29 has been ahead twice and second twice; October 6 has been ahead twice and September 22 ahead once and second three times. Winter wheat should not be seeded before the fly-free date indicated by the State entomologists.

TABLE 16.—EARLY AND LATE SEEDING OF WHEAT

	Sept. 1	Sept. 8	Sept. 15	Sept. 22	Sept. 29	Oct. 6	Oct. 13	Oct. 20	Oct. 27	Nov. 1
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
1915	.....	.....	23.33	30.00	26.67	24.67	11.33	2.33	2.00	.....
1916	5.37	.....	6.71	7.67	7.86	12.84	8.43	.....	6.32	.....
1917	39.83	42.50	43.00	46.00	47.45	40.33	29.67	10.33	11.17	.....
1918	34.47	11.73	11.73	19.43	10.45	10.27	11.73	3.30	.....	.....
1919	22.67	24.67	.....	27.17	31.17	26.00	22.83	21.50	.....	14.17
1920	.....	16.50	18.52	12.47	37.40	37.77	36.12	21.63	.....	.....
1921	.....	.....	21.00	22.32	25.00	26.00	30.33	28.67	.....	.....
Average	25.58	23.85	20.71	23.58	26.57	25.41	21.49	14.63	6.50	.....

TABLE 17.—VARIETY OF SOYBEANS, YIELD PER ACRE

Varieties	1920	1921	8-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Ohio 9100	13.37	24.33	18.29	2,010
Midwest*	27.65	23.27	22.08	2,239
Elton	26.20	27.94	23.48	1,849
Hamilton	29.43	25.89	21.74	2,093
Ebony	29.87	31.88	23.74	2,167
Ohio 7496	.....	.....	19.05†	2,453
Ohio 9016	13.25	15.50	17.11	1,730
Medium Green	24.87	22.83	19.45	2,045
New Era Cowpea	4.00	§	5.38‡	2,577

*Correct name for Mongol, Hollybrook, Medium Yellow, and Roosevelt. †6 years. ‡7 years. §Failed to get into condition to thresh.

SOYBEANS

Seven varieties of soybeans have been tested for a period of 8 years, one for 6 years, and the New Era cowpea for 7 years.

Ebony has been the highest yielder, Elton second, and Midwest third. New Era cowpeas are much inferior to the soybeans in yield of seed.

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BULLETIN

OF THE

Ohio Agricultural Experiment Station

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COUNTY EXPERIMENT FARMS IN OHIO

PART II

THE PAULDING COUNTY EXPERIMENT FARM

TENTH AND ELEVENTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

H. R. HOYT, SUPERINTENDENT
CARL DEISLER AND R. C. BEATTY, FOREMEN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$16,260.21	$16,260.21
Permanent improvements to March 1, 1920 and 1921	10,701.87	10,834.36
Permanent improvements during year, ending:		
March 1, 1921: on house No. 1, $12; on barn, $20.58; fence, $84.95; plantings in grove, $14.96	132.49	
March 1, 1922: furnace in house No. 1, $200; concrete work house No. 1, $10.75; drainage, $951.49; water system, $218.70; plantings, $3.83		1,384.77
Total permanent investment	$27.094.57	$28,479.34
Operating equipment:		
Livestock, March 1, 1921: 3 horses, 1 mule, $750; 51 hogs, $841.75	$ 1,591.75	
March 1, 1922: 2 horses, 2 mules, $790; 27 hogs, $740		$1,530.00
Machinery, tools, and harness	3,968.89	3,664.35
Crops, feeds, and seeds,		
March 1, 1921: corn, $270.48; oats, $140; barley, $12.48; straw, $8; hay, $100.80; wheat, $39.12; stover, $7; tankage, $66.50; mill feed, $28.95; salt, $2.50; seeds, $293.95	969.78	
March 1, 1922: corn $39.75; oats, $110; straw, $21; hay, $99; wheat, $44.55; tankage, $1; mill feed, $6; salt, $0.50; seeds, $138.65		460.45
Spray material		27.00
Fence material	21.00	20.00
Drain tile	30.00	4.00
Building material	73.00	43.50
Containers	27.00	21.50
Hog equipment	908.05	1,181.65
Sundries:		
March 1, 1921: coal, $2.80; oil and gasoline, $39.10; twine, $4; field day material, $14; plot stakes, $9	68.90	
March 1, 1922: coal, $1; disinfectant, $1; gas tar, $3; oil, $17.60; twine, $0.75; plot stakes, $8; field day material, $13		44.35
Total operating equipment	$ 7,658.37	$ 6,996.80
Total investment	34,752.94	35,476.14

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$1,549.94	$1,559.59
From Farm Sales:		
Livestock:		
1920—Horses, $380; hogs, $1,328.54; service fees, $6	1,714.54	
1921—Hogs, $1,317.34; service fees, $2.50		1,319.84
Crops:		
1920—Corn, $14.70; oats, $75.74; sugar beets, $266.36; soybeans, $44.33; apples, $81.55; wheat, $47.50	530.18	
1921—Oats, $69.83; wheat, $57.19; sugar beets, $82.41; soybeans, $13; apples, $4.60		227.03
Threshing outfit	540.00	
Sundries	13.56	10.44
Total receipts	$4,348.22	$3,116.90
Balance forward March 1	4,655.19	1,009.33
	$9,003.41	$4,126.23

Cr.

By Expenditures

For labor	$1,867.96	$1,719.51
For current expenses	1,706.87	1,000.21
For permanent improvements:		
1920—Buildings, $142.88; fence, $75.64; concrete work, $10.20; planting (ornamental), $13.16	241.88	
1921—Buildings, $200; drainage, $783.40; concrete work, $10.75; water system, $216.15; plantings (ornamental), $3.83		1,214.13
For machinery and tools	389.07	54.71
Threshing outfit	2,849.30	
For livestock: Hogs, $259; horses, $680	939.00	
Hogs		43.00
Total expense	$7,994.08	$4,031.56
Balance carried forward	1,009.33	94.67
	$9,003.41	$4,126.23

ITEMIZED CURRENT EXPENSES

	1920	1921		1920	1921
Seeds	$ 38.66	$ 31.30	Feed	$557.59	$213 17
Fertilizer	11.45	19.48	Horse shoeing	29.95	25.10
Spray material	26.26	30.28	Livestock equipment	68 44	99.10
Containers	3.75		Veterinary services	76 08	21.20
Binder twine	11 50		Immunizing hogs	142.88	93.40
Machinery hire	1.25	4.76	Service fees	5 00	
Livestock incidentals	12.95		Painting	31.75	
Bldg. maintenance	222.01	31.34	Communication	29 99	20.77
Fence	16.71		Publicity	6 35	8 65
Water supply	12 27	11.88	Office supplies	3.75	6.00
Implement repair	143 96	178.38	Fuel	18 93	
Engine maintenance	16.69	2 32	Miscellaneous hardware	7.45	2.73
Transportation	88.50	81.24			
Oil and gasoline	122.75	119 11	Total	$1,706.87	$1,000 21

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of farm in acres	1920	1921
Cultivated	61.65	61.65
Farmstead and old orchard	6.86	6.86
New orchard	2.50	2.50
Permanent pasture	5.50	5.50
Road (public)	5.50	5.50
Roads (farm)	8.63	8.63
Open ditch	1.56	1.56
Total area of farm	92.20	92.20

Plot	1920			1921		
Crop	Number of plots	Number of acres	Yield per acre	Number of plots	Number of acres	Yield per acre
Corn	73	6.20	63.6 bu.	58	5.25	46.2 bu.
Oats	59	5.90	71.2 bu.	60	6.00	43.1 bu.
Wheat	31	3.10	14.4 bu.	42	3.65	19.6 bu.
Wheat (spring)	1	.10	11.0 bu.	1	.10	5.0 bu.
Barley	1	.10	35.4 bu.	1	.10	6.6 bu.
Soybeans	16	1.60	13.5 bu.	27	2.15	20.9 bu.
Hay (mixed)	31	3.68	1.1 tons	61	6.58	1.5 tons
Hay (alfalfa)	6	.64	3.8 tons	6	.64	3.7 tons
Hay (sweet clover)*	11	1.30	.7 ton	11	1.30	1.4 tons
Sugarbeets	27	3.28	9.9 tons	27	3.28	9.6 tons
Total	245	24.60		294	29.05	

*Double cropped area, therefore, not included in total.

ANNUAL REPORT FOR THE YEAR ENDING FEBRUARY 28, 1921

H. R. HOYT

HOG WORK

There were 25 head of swine all told on the farm at the beginning of the year 1920, and 51 at the beginning of 1921. In 1920 16 pigs were raised from the spring litters and 36 were added by purchase. In June, 11 of the pigs died of cholera before the disease could be checked. Forty pigs were raised from five fall broods.

One field of corn in the corn-corn-oats-pasture rotation was hogged down in 1920. Nearly one ton of sweet clover hay per acre and a small quantity of seed were harvested from the pasture field in this rotation.

CROP AND LABOR STATISTICS—Concluded

Field crops	1920		1921	
Crops	Acres	Yield per acre	Acres	Yield per acre
Corn (hogged-down)	5.75	76.6 bu.	10.25	58.6 bu.
Corn (husked)	9.34	58.3 bu.	1.72	50.2 bu.
Oats	1.72	60.3 bu.	9.34	24.6 bu.
Barley	4.50	33.3 bu.	.....	.....
Soybeans	4.83	10.3 bu.	.....	.....
Hay (alfalfa)	4.67	1.4 ton	1.25	1.6 ton
Hay (sweet clover)	4.50	.9 ton	.....	.....
Sweet clover seed	4.50	45.0 lb.	.....	.....
Fallow land	.62	.....	.....	.....
Corn and soybeans	1.25	hogged	1.25	hogged
Pasture	7.87	hogged	10.04	hogged
Totals	49.55	.....	33.85	.....
Less double and triple cropped area	12.50	.....	1.25	.....
	37.05	.....	32.60	.....

Highest and Lowest Plot Yields per Acre

		Corn	Oats	Wheat	Soybeans	Mixed hay	Alfalfa	Sugar-beets
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Highest	1920	83.5	100.9	21.8	17.0	1.6	4.8	17.3
	1921	62.8	62.8	28.3	33.0	3.0	4.6	14.9
Lowest	1920	42.7	45.0*	7.6†	9.8	.9	2.5	8.3
	1921	21.4	15.6	8.8	8.3	1.2	2.6	5.9

For the year	1920	1921
Number of work horses	4	4
Number of crop acres per work horse	16.9	15.2
Number of man-hours for year beginning March 1	6,369	6,378
Number of horse-hours for year beginning March 1	3,314	3,145
Number of tractor-hours for year beginning March 1	88.5	58.2

*Oats in plot damaged by chinch bugs. †Wheat in plot winter-killed.

The comparison of hogging-down corn in which rape was sown at the last cultivation and with which tankage was fed as a protein supplement, with hogging-down corn in which soybeans were grown to furnish the protein supplement, was continued this year. The hogs getting the corn and tankage again made the larger gains. See Table 1.

EXPERIMENTAL WORK

The clover seeding in Rotation III failed and soybeans were planted instead with the expectation of harvesting the crop for hay. Good crops of clover and alfalfa were harvested. As the soybeans were not needed for hay, they were cut for seed, yielding 8.5 bushels per acre.

A fertility rotation, the object of which is to determine the effect of calcium sulphate, sulphur, and hydrated lime on the physical condition of the soil, and the influence of sulphur on plant growth, was begun in 1920.

Biennial white sweet clover replaced medium red clover in the variety rotation in order to compare its value as a hay and seed crop and also its effect on the soil with the value and effect of the medium red clover grown in the check plots in the fertility rotation.

TABLE 1.—HOGGING-DOWN CORN, FIELD 6, TWO AND ONE-HALF ACRES

	1920		1921	
	East half corn and rape with tankage	West half corn and soybeans	East half corn and rape with tankage	West half corn and soybeans
Number of hogs per acre	6	6	7	7
Number of days required to hog-down field	35	52	28	41
Average initial weight per hog, pounds	176.3	175.8	94.0	93.8
Average daily gain per hog, pounds	2.09	1.45	1.68	1.38
Tankage consumed per acre, pounds	54	.....	56	.....
Pork produced per acre, pounds	351.2	363.2	264.0	317.6
Shelled corn per acre, 15.5 percent of moisture, bushels	28.7	41.5	16.4	23.0
Feed consumed per 100 pounds of gain:				
Corn, bushels	8.29	11.4	6.2	7.2
Tankage, pounds	15.3	.....	21.2	.....
Cost of tankage per 100 pounds of gain (6 cts. per pound 1920, 2.8 cts. per pound 1921	$ 0.92	.....	$ 0.59	.....
Cost of tankage per acre	$ 3.24	.....	$ 1.57	.....
Cost of soybean seed per acre	.....	$ 2.24	.....	$ 0.45
Cost of rape seed per acre	$ 0.90	.....	$ 0.85	.....
Gross return (hogs valued at $12.50 per cwt. in 1920, at $7.50 in 1921)	$43.90	$45.40	$19.80	$23.82
Return, less cost of tankage, and rape and soybean seed: Per acre	$39.76	$43.16	$17.38	$23.37
Per bushel of corn	$ 1.38	$ 1.04	$ 1.06	$ 1.01
Market value of standing corn at beginning of test at 87 cts. per bushel 1920, at 50 cts in 1921	$25.02	$36.10	$ 8.20	$11.50
Gain per acre by maketing corn through hogs	$14.74	$ 7.06	$ 9.18	$11.87
Gain per bushel of corn by marketing through hogs	$ 0.51	$ 0.17	$ 0.56	$ 0.51

Note: No interest on investment, rent of land, and cost of labor is considered in this summary.

ORCHARD WORK

Twenty-one bushels of Jonathan and Grimes Golden apples were harvested from the orchard planted in 1912. A few bushels of crab apples and 197.5 bushels of picked and drop apples were harvested from the old orchard.

SUMMARY

The season of 1920 at the farm was favorable for high yields of all crops except wheat. Ice damaged the wheat during the winter and the yield for this reason was low. The straw mulch saved the greater part of the wheat on that part of the variety block which was mulched and a fair yield was obtained.

Chinch bugs did some damage to the barley and corn in the hog-work rotation.

The soybeans, which were seeded on an earlier date than usual, produced a high yield of well matured beans.

FINANCIAL SUMMARY OF HOG WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Livestock March 1, 1920	$ 773.00	Livestock February 28, 1921	841.75
Equipment and land	1,313.43	Equipment and land	1,419.38
Livestock purchased	259.00	Supplies	4.45
Equipment purchased	73.63	Livestock sold	1,285 69
Feed fed including pasture	1,431.67	Boar service fees	9.00
Man-labor, 1330 hours at 40c per hour	532.00	Experimental labor, 861 man-hours at 40c per hour	344.40
Horse-labor, 212 hours at 20c per hour	42.40	Experimental horse-labor 83 at 20c	16.60
Miscellaneous expense:		To balance (loss)	759.74
Veterinary and immunizing from cholera	145.38		
Drugs, salt, and louse spray	28.60		
Feeding floors	78.90		
Coal for tank heater	3.00		
Total	$4,681.01	Total	$4,681.01

FINANCIAL SUMMARY OF HOG WORK

March 1, 1921 to February 28, 1922

DEBITS	Value	CREDITS	Value
Livestock	$ 841.75	Livestock	$ 740.00
Equipment and land	1,419.38	Equipment and land	1,594.05
Livestock purchased	43 00	Livestock sold	1,317.34
Equipment purchased	280.66	Boar service	2 50
Feed fed including pasture	915.04	Experimental man-hours, 874 at 34c	297.16
Man-hours, 1463 at 34c	497.42	Experimental horse-hours, 81.5 at 17c	13.85
Horse-hours, 218.5 at 17c	37.14	Extra cost of experimental feed.	48.98
Miscellaneous expense:		To balance (loss)	132.96
Veterinary services	14.25		
Immunizing from cholera	90.15		
Worm medicine	5.00		
Coal for tank heater	2.00		
Salt	1.05		
Total	$4,146.84	Total	$4,146.84

ANNUAL REPORT FOR THE YEAR ENDING FEBRUARY 28, 1922

On November 30, 1920, 26 pigs were put on feeding test in which corn with tankage fed as the protein supplement was compared with corn with ground soybeans as the protein supplement. Those on corn and tankage made good gains; while those fed corn and soybeans did not do well, some of them made no gain in weight and one died from the effect of the feeding. No minerals were fed in addition to the corn and soybeans. In hog feeding work at the Station at Wooster, when 3 pounds of a mixture of equal parts of ground limestone, steamed bonemeal, and salt was fed with 97 pounds of the mixture of ground corn and ground soybeans, the hogs did better than when corn and soybeans were fed with no minerals added.

From ten spring broods 64 pigs were raised to weaning time, seven of these died later from kidney worms and other causes leaving 57 that were marketed. From two fall litters, 16 pigs were saved.

TABLE 2.—Summary result of hogging down corn, Field 3, 1921

Per acre basis	North 2.25 acres	South 2.25 acres
Number of hogs in field	20	20
Number of days required to hog down field	35	40
Average initial weight per hog, pounds	74.6	73.8
Average daily gain per hog, pounds	1.99	1.55
Tankage consumed, pounds	130.6	153.8
Pork produced, pounds	619.1	554.2
Yield of shelled corn, 15.5 percent of moisture, bushels	36.4	47.2
Feed consumed per 100 pounds of gain: Corn, bushels	5.9	8.5
Tankage, pounds	29.1	27.7
Cost of tankage per 100 pounds of gain (2.8 cts. per pound)	$ 0.81	$ 0.77
Cost of tankage per acre	$ 3.65	$ 4.31
Gross return per acre (hogs valued at $7.50 and $7. per cwt., respectively)	$46.43	$38.79
Return less cost of tankage: Per acre	$42.78	$34.48
Per bushel of corn	$ 1.17	$ 0.73
Market value of standing corn at beginning of test at 50 cents a bushel	$18.20	$23.60
Gain per acre by marketing corn through hogs	$24.58	$10.88
Gain per bushel of corn by marketing through hogs	$ 0.67	$ 0.23

Note: Hogs were turned on north one-half of field on August 23 and on south one-half on September 14.

No interest on investment, rent of land and cost of labor is considered in this summary.

Two fields of corn in the 4-year rotation and Field 6 in continuous corn, were hogged down. The hogs made good gains while on these fields.

The object of harvesting the halves of Field 3 separately was to learn whether the hogs made better gains on corn that was just beginning to dent or on corn that was more nearly mature. The entire field was planted May 5 and the hogs were turned on the north half August 23 and on the south half September 14. Several

years will be required to secure the data necessary to determine the stage of maturity at which it is most profitable to turn the hogs on the corn. For this year's results, see Table 2.

As the hogs cleaned up the corn on the test fields they were turned into the corn on Field 1, 4.5 acres, with a calculated yield of 310 bushels. The hogs on this field consumed 733 pounds of tankage and produced 2,248 pounds of pork.

TABLE 3.—YIELDS OF CORN IN HOG WORK. Corn-corn-oats-pasture rotation, fields 1, 2, 3, and 4, and in continuous culture, field 6
Bushels per acre

	1916	1917	1918	1919	1920	1921	Average
Field 1	.....	44.0	52.8	.....	.....	67.8	54.8
Field 2	34.1	.....	.....	45.3	57.9	.....	45.8
Field 3	44.8	42.0	.....	.....	95.7	63.2	61.4
Field 4	.....	.....	43.7	43.8	.....	.....	43.8
Field 6, East half	37.9*	35.9*	31.2	32.3	42.5	20.1	31.5†
Field 6, West half	.....	.....	34.0	37.8	67.6	25.8	41.3†

*Yields per acre for entire field. †Four-year average.

HOG CHOLERA

It is necessary to vaccinate all hogs each year to prevent losses from hog cholera. There have been no losses from this disease of hogs that were given the serum and virus, or simultaneous treatment, before the cholera appeared in the herd.

On account of the limited amount of land available for hog work, it is impossible to run the hogs on soil that is not infested with worm eggs and all pigs have to be treated for the removal of worms.

Good pasture is necessary in order that pork may be produced at a minimum cost. Sweet clover in a mixed pasture with other clovers and alfalfa has not been satisfactory on this farm; since it grows faster than the other clovers, and is not readily eaten, it soon smothers them. A mixture of 3 pounds of red clover, 2 of alsike, and 5 of alfalfa seed per acre, seeded with the oats has always produced a satisfactory stand of pasture on this farm.

Chinch bugs damage barley to such an extent that it is not a profitable substitute for oats in a rotation. If this could be done more home grown feed could be supplied for the hogs.

EXPERIMENTAL WORK

All work was continued as in preceding years.

ORCHARD WORK

The heavy freeze, April 11, killed all of the fruit buds in the young apple orchard and nearly all in the old orchard. Three bushels of picked and 11.5 bushels of drop apples were harvested from the old orchard.

Average yields of wheat, sugarbeets, and hay and high yields of soybeans were produced in 1921. The year was unfavorable to high yields of corn and oats.

The highest yield of corn was 68.9 bushels per acre, from Field 1 in the hog-work rotation, and the lowest, 33.9 bushels per acre, from the spring-plowed land in Rotation VI. The highest yield of oats, 52.8 bushels per acre, was harvested from the sugarbeets-oats-hay rotation and the lowest, 17.1 bushels per acre, from the undrained land in Field 8. Wheat made an average yield of 23 bushels and soybeans 25 bushels per acre. The alfalfa in Block U was cut three times yielding a total of 3.98 tons per acre. The yield of sweet clover in the variety rotation was 1.6 tons of good hay per acre. Extremely hot, dry weather shortly after the first cutting killed over half the plants and no attempt was made to harvest a second hay or a seed crop. The medium red clover yielded 1.75 tons per acre. The first planting, May 7, of sugarbeets resulted in a poor stand and they were replanted June 20. The average yield was 8.5 tons per acre.

On account of the mild winter there was no noticeable difference in the plots of wheat that were straw mulched and those that were not mulched. The yield of hay from the plots that were mulched the previous winter was greater than from the plots where the wheat was not mulched. Barley in the variety rotation was practically destroyed and the plot of spring wheat in the same rotation was badly damaged by chinch bugs. After these plots were harvested it was necessary to place a barrier of tar to keep them out of nearby corn.

COMPARISON OF ROTATIONS, CROP COSTS AND NET RECEIPTS PER ACRE

Table 4 gives the 7-year average yield and gross value of the crops grown in three of the rotations. Table 5 gives the 4-year average labor and miscellaneous costs and net receipts per acre for the crops grown in four rotations. The first three in Table 5 are the same as in Table 4. Table 6 gives the miscellaneous costs and net receipts per acre for 1921 for the same rotations as in Table 5.

SUMMARY OF COMPARISON OF ROTATIONS TABLES

The high prices and good yields of sugarbeets in 1918, 1919, and 1920 make Rotation III the most profitable for the 4-year period. See Table 4.

Wheat has yielded more after oats than after soybeans, but the high labor cost of preparing a seed-bed after oats has resulted in a greater net profit for the wheat following soybeans.

TABLE 4.—Comparison of rotations

Seven-year average yield and gross value per acre of unfertilized plots, 1915-1921

Crop	Yield			Value		
	Rotation I	Rotation II	Rotation III	Rotation I	Rotation II	Rotation III
Corn	54.1 bu.	57.7 bu.	.....	$41.37	$40.82	.....
Sugarbeets	.....	.....	11.0 tons	.....	.....	$ 87.65
Oats	68.3 bu.	.....	56.6 bu.	34.88	.....	27.96
Soybeans	.....	16.2 bu.	.....	.....	45.02	.....
Wheat*	18.8 bu.	14.7 bu.	.....	36.22	27.47	.....
Hay†	2.2 tons	2.3 tons	1.87 tons	32.09	33.76	28.99
Average gross value of all crop rotations				$144.56	$147.07	$144.60
Average gross value per acre				36.14	36.77	48.20

Rotation I—4-year, corn, oats, wheat, hay.
Rotation II—4-year, corn, soybeans, wheat, hay.
Rotation III—3-year, sugarbeets, oats, hay.

*Wheat winter-killed in 1916 and 1917 and oats were grown instead, in all except Rotation II in 1916.

†A crop of clover seed of 18 pounds per acre was harvested from Rotations I and II and 17 pounds per acre from Rotation III in 1919.

The hay seeding in Rotation III, having failed in 1920, soybeans, which made a yield of 8.5 bushels of seed per acre, were grown in its place.

Values are computed by using the market value of each crop at harvest time each year less the cost of marketing.

TABLE 5.—Four-year Average Labor and Miscellaneous Costs and Net Receipts per Acre, 1918-1921

	Man hours	horse hours	Labor cost	Miscellaneous costs	Total costs	Yield	Gross receipts	Net receipts	Cost per unit
Rotation I									
Corn	72.9	62.9	$34.78	$0.59	$35.37	56.2 bu.	$47.79	$12.42	$ 0.62 bu.
Oats	26.8	28.3	13.42	4.03	17.45	73.5 bu.	41.80	24.36	0.23 bu.
Wheat	42.9	72.1	27.40	6.22	33.62	24.6 bu.	40.87	7.24	1.35 bu.
Hay	16.9	23.2	9.70	6.05	15.75	1.5 tons	27.48	11.73	10.47 ton
Average net value per crop									$13.94
Rotation II									
Corn	72.2	60.5	$35.98	$0.59	$36.57	54.7 bu.	$46.75	$10.18	$ 0.67 bu.
Soybeans	48.7	66.4	27.56	5.04	32.60	15.9 bu.	47.89	15.29	2.23 bu.
Wheat	18.1	22.8	9.81	5.95	15.76	17.8 bu.	32.32	16.55	0.90 bu.
Hay	18.1	20.2	9.39	6.05	15.44	1.5 tons	28.70	13.16	9.95 ton
Average net value per crop									$13.79
Rotation III									
Sugarbeets	65.9*	124.8	$68.73*	$4 24	$72.97	11.1 tons	$110.26	$37.29	$ 6.63 ton
Oats	24.1	21.9	10.89	3.84	14.73	57.2 bu.	31.17	16.44	0.25 bu.
Hay	15.1	15.6	7.96	4.68	12.64	1.07 tons	23.59	10.95	12.91 ton
Average net value per crop									$21.56
Rotation IV									
Corn	45.5	85.2	$29.14	$0.59	$29.73	42.9 bu.	$34.35	$ 4.62	$ 0.69 bu.
Oats	23.9	26.0	12.32	3.92	16.24	58.6 bu.	32.38	16.14	0.29 bu.
Average net value per crop									$10.38

*Includes $24 per acre in 1918 and in 1919, $34.65 in 1920, and $23 in 1921 paid to the Sugar Company for extra man-labor.

Under head of "miscellaneous costs", charge is made for seed, twine, and for the fuel and oil used in threshing.

TABLE 6.—Labor and miscellaneous costs and net receipts per acre, 1921

Crop	Man hours	Horse hours	Labor cost	Miscellaneous costs	Total cost	Yield	Gross receipts	Net receipts	Cost per unit
Rotation I									
Corn	56.0	46.5	$26.94	$0.45	$27.39	52.7 bu.	$18.44	—$8.95	$0.52
Oats	14.0	16.5	7.56	2.79	10.35	42.5 bu.	12.33	1.98	0.24
Wheat	28.0	48.5	17.76	6.38	24.14	22.5 bu.	23.40	— 0.74	1.07
Hay	14.5	21.0	8.50	7.81	16.31	1.9 tons	17.73	1.42	8.55
Average net value per crop									$—1.57
Rotation II									
Corn	65.7	52.5	$31.25	$0.45	$31.70	47.7 bu.	$16.70	—$15.00	$ 0.66
Soybeans	38.5	67.0	24.48	4.73	29.21	24.3 bu.	48.60	19.39	1.20
Wheat	11.0	16.0	6.46	6.30	12.76	20.5 bu.	21.32	8.56	0.62
Hay	16.0	24.0	9.52	7.81	17.33	1.7 tons	15.84	—1.89	10.19
Average net value per crop									$2.76
Rotation III									
Sugarbeets	57.6	113.7	$61.91*	$4.29	$66.20	8.9 tons	$60.14	—$6.06	$7.43
Oats	15.0	15.9	7.80	3.11	10.91	50.6 bu.	14.67	3.76	0.21
Hay	12.3	10.7	6.00	6.50	12.50	1.7 tons	15.57	3.07	7.35
Average net value per crop									$0.19
Rotation IV									
Corn	35.5	74.0	$24.65	$0.45	$25.10	37.7 bu.	$13.19	—$11.91	$0.66
Oats	15.5	19.5	8.58	2.36	10.94	28.4 bu.	8.23	—2.71	0.38
Average net value per crop									$—3.65

*Includes $23 paid to sugar company for extra man-labor.

TABLE 7.—Cost account in tile drainage experiment, installed Sept., 1921

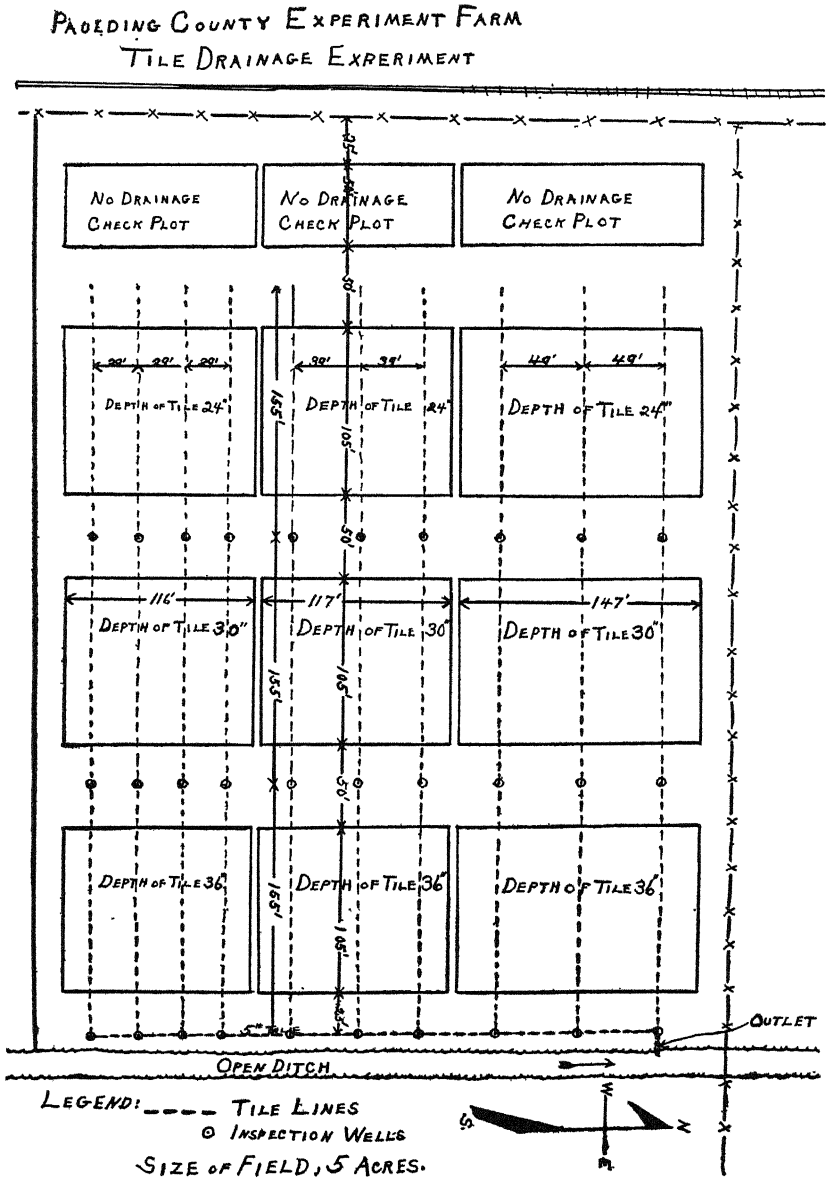
	Man hours	Value	Horse hours	Value	Total value
Hauling tile, 1.5 miles	22.	$ 7.48	37.	$6.29	$ 13.77
Stringing tile	10.5	3.57	21.	3.57	7.14
Laying tile	63.	21.42	.....	.....	21.42
Blinding tile	9.	3.06	.....	.....	3 06
Filling trenches	6.2	2.11	8.9	1.51	3.62
Gathering and hauling surplus tile	1.5	.51	3.	.51	1.02
Cost of ditching machine and operator	.....	.....	.....	.....	98.41
Cost of tile, 281 rods	.....	.....	.....	.....	113.38
Total cost	.....	.....	.....	.....	$266.02
Cost per acre	.....	.....	.....	.....	58.18
Cost per rod	.....	.....	.....	.....	.93

Note.—The tile lines were laid at an average distance of 39.8 feet apart. Of these 93 rods were laid 30 inches deep at a cost of 30 cents a rod for digging, and 188 rods 36 inches deep at 38 cents a rod for digging. Man labor was reckoned at 34 cents an hour and horse labor at 17 cents. Four-inch tiles were used in the lateral lines and five-inch in the main.

Corn in Rotation IV, Table 5, is husked from the standing stalks and that in Rotations I and II is cut and husked from the shock, which accounts for the greater labor cost in Rotations I and II.

TILE DRAINAGE EXPERIMENT

A tile drainage experiment was installed in September, 1921, to determine if possible the proper distance apart to place tile lines and the proper depth to lay the tile to secure best results in draining similar soils. The map shows the layout of the tile lines. For detailed cost of tileing, see Table 7.



THE MAINTENANCE OF SOIL FERTILITY

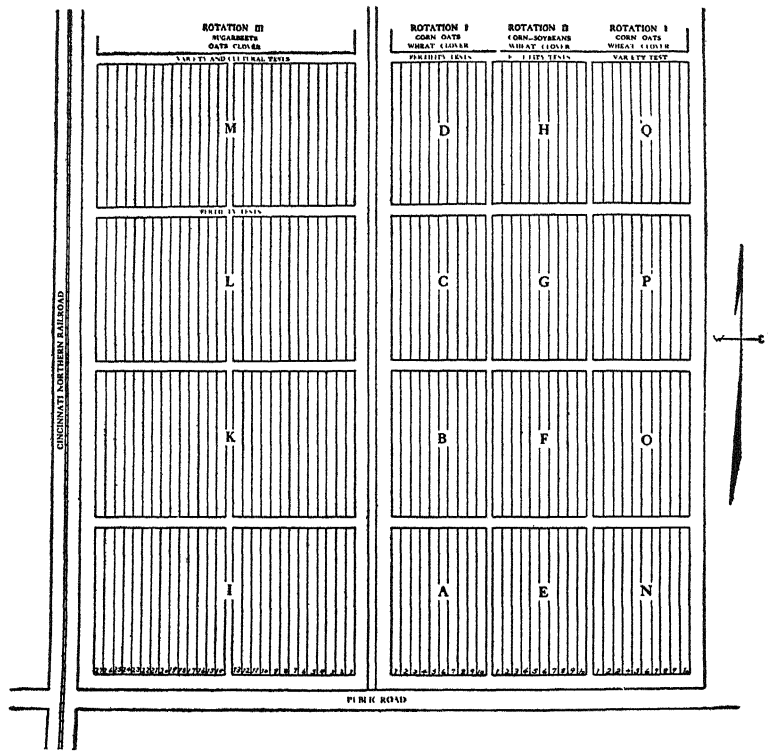
DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

Four rotations are being conducted on the Paulding County Experiment Farm—namely:

Rotation I: Corn, oats, wheat, clover.
Rotation II: Corn, soybeans, wheat, clover.
Rotation III: Sugarbeets, oats, clover.
Rotation IV: Corn, oats.

Rotations I and II which duplicate in treatment the similar rotations in Miami County, and Rotation III were begun in 1912. Rotation IV was begun in 1915. The plans of fertilizing in Rotations I and II are shown in Table 8, and those of Rotations III and IV in Tables 12 and 16. The arrangement of plots in Rotations I, II, and III is shown in the diagram below, and the outcome of the work to 1921 is shown in Tables 9 to 19.



Arrangement of plots, Paulding County Experiment Farm. Plots one-tenth acre. Tile drains are laid east and west across these plots about 5 rods apart, emptying into a large open ditch running north and south through the middle of the tract

Fertilizers and manure on corn.—Six corn crops were grown in Rotations I and II before any benefit from the fertilizers became manifest. The later crops, however, apparently show some response to treatment, although it is still very irregular and uncertain.

In the two rotations which receive identical treatments on the Miami and Paulding County Experiment Farms, the unfertilized corn has averaged 52.86 bushels per acre on the Paulding farm and 51.82 bushels on the Miami farm for the entire period of the experiment; but while the fertilizers and manure have increased the yields of corn in Miami County by from 7 to 20 bushels per acre, there is no decisive evidence that the same treatments have produced any increase in Paulding County.

TABLE 8.—Plan of fertilizing, Paulding County Experiment Farm

Plot	On corn				On oats			On wheat		
	Acid phosphate	Muriate potash	Nitrate soda	Additional treatment	Acid phosphate	Muriate potash	Nitrate soda	Acid phosphate	Muriate potash	Nitrate soda
	Rotation I: Corn-oats-wheat-clover									
1										
2	200				100			200		
3	200	50			100	20		200	20	
4										
5	200	50	50		100	20	30	200	20	80
6	200	50	50	*	100	20	30	200	20	80
7										
8	Manure, 8 tons							200	50	50
9	Manure, 8 tons, phosphated							200	50	50
10										
	Rotation II: Corn-soybeans-wheat-clover									
	On corn				On soybeans			On wheat		
1										
2	200				100			200		
3	200	50			100	20		200	20	
4										
5	200	50	50		100	20	30	200	20	80
6	130	50	20		70	20	10	160	20	20
7										
8	160	20	20		100			170		30
9	160	20	20	†	100			170		30
10										

*Sugar-factory lime, 2 tons. †Catch crop to follow corn.

Taking the 10-year period, 1910-1919, the average yield of corn in Paulding County as a whole, as shown by statistics collected by the township assessors, was 40.2 bushels per acre and that in Miami County was 41.6 bushels.

Fertilizers on oats.—The 10-year average unfertilized yield of oats following corn has been 60.99 bushels, while that on the fertilized land has averaged 60.40 bushels. At the Miami farm the average yields under the same treatments have been 46.63 bushels on unfertilized land and 54.73 bushels after fertilizing.

The yields of oats following sugarbeets have been 54.20 bushels on the unfertilized land and 54.62 bushels on the fertilized land, the fertilizers being given to the beet crops only.

The 2-year rotation of corn and oats has been in progress 7 years, with average yields on the unfertilized land of 48.54 bushels of corn and 53.23 bushels of oats. For the same period the yields in the 4-year rotation of corn, oats, wheat, and clover have been 53.89 bushels of corn and 69.00 bushels of oats.

Fertilizers and manure on wheat.—The wheat crops have shown larger response to fertilizing than the corn or oats and in favorable seasons the yields have been good. The crops of 1916 and 1917 were entirely lost by winter-killing, but the average yields for the seven crops thus far harvested have been 28.73 bushels per acre after oats and 26.26 bushels after soybeans on unfertilized land, and on the fertilized land, 31.40 bushels after oats and 31.41 bushels after soybeans. At the Miami County farm the unfertilized yields of wheat have been 12.10 bushels after oats and 14.03 bushels after soybeans, and the fertilized yields have been 26.36 bushels after oats and 26.76 bushels after soybeans. The average increase after soybeans is less than that after oats because Plots 6, 8, and 9 receive smaller applications of fertilizing materials in the soybean than in the oats rotation.

Fertilizers and manures on soybeans.—The unfertilized yields of soybeans have been 16.96 bushels on the Paulding farm and 21.31 bushels on the Miami farm, and the yields on the fertilized land have been 18.30 and 23.31 bushels, respectively, an average gain for fertilizing of 1⅓ bushels on the Paulding and nearly 2 bushels on the Miami farm.

The relative yields of oats and soybeans under identical treatments are shown in Table 15.

Table 15 indicates that the soil and climatic conditions are relatively favorable to oats in Paulding and to soybeans in Miami County.

TABLE 9.—Fertilizers and manure on CORN, Paulding County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot No.
	Rotation I: Corn-oats-wheat-clover	Block B				Block C				10-year average				
1	None	54.29	2,486			52.14	3,150			50.81	3,381			1
2	Acid phosphate, 200 lb	60.71	2,780	2.61	119	51.43	3,400	—2.14	100	51.06	3,613	—1.27	115	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	58.57	2,684	—3.33	—151	51.43	3,400	—3.57	—50	51.31	3,855	—2.53	240	3
4	None	65.71	3,010			56.43	3,600			55.35	2,732			4
5	Acid phos., 200 lb.; mur. potash, 50 lb.; nitrate soda, 50 lb.	67.14	3,075	1.19	54	59.29	3,600	4.29	267	56.01	3,874	1.03	220	5
6	Acid phos., 200 lb.; mur. potash, 50 lb.; nitrate soda, 50 lb.; sugar-factory lime, 2 tons	68.57	3,140	2.38	109	56.43	3,400	2.86	333	53.08	3,764	—1.54	188	6
7	None	66.43	3,042			52.14	2,800			54.26	3,498			7
8	Untreated manure, 8 tons	75.00	3,435	7.84	360	51.43	2,900		67	54.95	3,557	1.07	40	8
9	Phosphated manure, 8 tons	69.29	3,174	1.43	67	49.29	2,900	—1.42	33	51.70	3,684	—1.78	148	9
10	None	68.57	3,140			50.00	2,900			53.09	3,555			10
	Average unfertilized yield	63.43	2,920			52.68	3,112			53.38	3,341			
	Average fertilized yield	66.55	3,048			53.22	3,267			53.02	3,724			
	Rotation II: Corn-soybeans-wheat-clover	Block F				Block G				9-year average				
1	None	67.86	3,190			47.86	2,450			51.59	3,311			1
2	Acid phosphate, 200 lb.	70.00	3,290	1.66	78	46.43	3,550	.48	1,033	50.22	3,400	—1.28	68	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	70.00	3,290	1.19	55	50.71	2,850	6.66	267	49.87	3,377	—1.53	24	3
4	None	69.29	3,257			42.14	2,650			51.32	3,375			4
5	Acid phos., 200 lb.; mur. potash, 50 lb.; nitrate soda, 50 lb.	71.43	3,358	2.67	126	49.29	3,250	4.97	567	54.05	3,677	2.07	225	5
6	Acid phos., 130 lb.; mur. potash, 50 lb.; nitrate soda, 20 lb.	62.14	2,921	—6.10	—287	44.29	2,850	—2.20	133	50.95	3,435	—1.70	94	6
7	None	67.71	3,183			48.67	2,750			53.31	3,606			7
8	Acid phos., 160 lb.; mur. potash, 20 lb.; nitrate soda, 20 lb.	65.43	3,075	—.28	—14	50.00	3,100	.17	350	53.68	3,815	.42	213	8
9	Acid phos., 160 lb.; mur. potash, 20 lb.; nitrate soda, 20 lb.*	61.43	2,887	—2.28	—107	52.86	2,700	1.88	—50	52.25	3,504	—.96	—93	9
10	None	61.71	2,900			52.14	2,750			53.17	3,591			10
	Average unfertilized yield	66.64	3,132			47.68	2,650			52.35	3,471			
	Average fertilized yield	66.72	3,137			48.93	3,050			51.84	3,535			

*Catch crop after corn.

TABLE 10.—Fertilizers and manure on OATS and SOYBEANS following corn, Paulding County Experiment Farm
Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
	OATS in Rotation I: Corn-oats-wheat-clover	Block A				Block B				10-year average				
1	None	90.00	1,820			41.87	1,760			61.38	2,906			1
2	Acid phosphate, 100 lb	82.50	2,310	—8.54	573	38.12	1,530	—3.70	—282	58.67	2,767	—2.85	—120	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	93.12	2,070	1.04	417	39.37	1,590	—2.40	—273	62.73	2,746	1.08	—123	3
4	None	93.12	1,570			41.72	1,915			61.78	2,850			4
5	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.	100.94	2,370	5.32	413	46.25	2,070	5.05	122	63.81	2,993	2.65	165	5
6	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.*	69.37	2,630	—28.75	287	39.22	1,495	—1.47	—487	60.73	2,714	.18	—90	6
7	None	100.62	2,730			40.17	2,015			59.93	2,782			7
8	Untreated manure on corn	68.75	1,550	—28.45	—983	43.12	1,870	.92	—97	57.09	2,720	—3.16	—65	8
9	Phosphated manure on corn	89.06	2,300	—4.71	—37	40.31	1,610	—3.91	—308	59.37	2,747	—1.19	—40	9
10	None	90.35	2,140			46.25	1,870			60.88	2,790			10
	Average unfertilized yield	93.52	2,065			42.50	1,890			60.99	2,832			
	Average fertilized yield	83.96	2,205			41.06	1,694			60.40	2,781			
	SOYBEANS in Rotation II: Corn-soybeans-wheat-clover	Block E				Block F				9-year average				
1	None	13.83	1,520			20.50	2,220			15.97	1,704			1
2	Acid phosphate, 100 lb	13.00	1,520	—1.39	150	24.33	2,140	3.55	—113	17.23	1,442	.95	—240	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb.	13.67	1,330	—1.27	110	25.83	2,450	4.78	163	18.06	1,718	1.48	—59	3
4	None	15.50	1,070			21.33	2,320			16.90	1,636			4
5	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.	14.00	1,210	—.61	103	27.50	2,050	5.84	—233	18.43	1,683	1.51	82	5
6	Acid phos., 70 lb.; mur. potash, 20 lb.; nit. soda, 10 lb.	14.67	1,170	.95	27	26.33	2,220	4.33	—27	17.75	1,614	.81	48	6
7	None	12.83	1,180			22.33	2,210			16.96	1,531			7
8	Acid phosphate, 100 lb	16.17	1,330	2.73	153	30.83	2,350	4.94	—63	19.35	1,649	2.04	92	8
9	Acid phosphate, 100 lb.†	15.00	1,400	.94	227	31.33	2,870	1.89	253	19.04	1,760	1.38	175	9
10	None	14.67	1,170			33.00	2,820			18.01	1,613			10
	Average unfertilized yield	14.21	1,235			24.29	2,392			16.96	1,626			
	Average fertilized yield	14.42	1,327			27.69	2,347			18.31	1,644			

*Sugar-factory lime on corn. †Catch crop after corn.

TABLE 11.—Fertilizers and manure on WHEAT, Paulding County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
	Rotation I: Corn-oats-wheat-clover	Block D				Block A				7-year average				
1	None	20.00	1,550			24.00	2,010			30.43	2,383			1
2	Acid phosphate, 200 lb	18.50	1,340	—.61	—163	17.38	2,160	—4.89	177	28.17	2,169	—1.36	—174	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	19.17	1,450	.95	—7	17.50	2,450	—2.95	493	29.07	2,307	.44	3	3
4	None	17.33	1,410			18.67	1,930			27.73	2,265			4
5	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 80 lb.	20.17	1,540	2.56	163	22.17	2,370	2.11	440	32.54	2,620	4.77	415	5
6	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 80 lb.*	21.83	1,490	3.94	147	27.67	1,790	6.23	—140	32.50	2,369	4.69	226	6
7	None	18.17	1,310			22.83	1,930			27.85	2,083			7
8	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.	17.50	1,300	—.50	—20	27.33	2,160	4.00	243	33.19	2,600	4.98	504	8
9	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.	18.17	1,360	.33	30	28.33	2,200	4.50	297	32.93	2,566	4.36	457	9
10	None	17.67	1,340			24.33	1,890			28.93	2,122			10
	Average unfertilized yield	18.29	1,402			22.46	1,940			28.73	2,213			
	Average fertilized yield	19.22	1,413			23.39	2,188			31.40	2,445			
	Rotation II: Corn-soybeans-wheat-clover	Block H				Block E				7-year average				
1	None	15.00	950			20.67	1,860			26.95	2,289			1
2	Acid phosphate, 200 lb	14.67	1,220	1.39	350	24.50	1,930	4.28	193	30.88	2,475	4.35	200	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	18.17	1,260	6.62	470	21.83	1,590	2.05	—23	31.88	2,351	5.77	90	3
4	None	9.83	710			19.33	1,490			25.69	2,248			4
5	Acid phos., 200 lb.; mur. potash, 20 lb.; nit. soda, 80 lb.	20.17	1,440	9.39	603	27.00	2,180	7.22	567	33.28	2,869	7.76	652	5
6	Acid phos., 160 lb.; mur. potash, 20 lb.; nit. soda, 20 lb.	12.50	1,000	.78	37	24 33	1,640	4.11	—97	31.10	2,611	5.76	427	6
7	None	12.67	1,090			20.67	1,860			25.17	2,153			7
8	Acid phosphate, 170 lb.; nitrate soda, 30 lb.	12.67	840	1.67	—167	24.17	1,950	3.17	127	30.36	2,589	4.49	322	8
9	Acid phosphate, 170 lb.; nitrate soda, 30 lb.	8.33	750	—1.01	—173	26.17	1,930	4.83	143	30.93	2,677	4.37	296	9
10	None	7.67	840			21.67	1,750			27.25	2,495			10
	Average unfertilized yield	11.29	897			20.58	1,740			26.26	2,296			
	Average fertilized yield	14.42	1,085			24.67	1,870			31.41	2,595			

*Sugar-factory lime on corn. †Catch crop on corn.

Note: The wheat crops of 1916 and 1917 were destroyed by winter-killing, and oats were grown instead.

TABLE 12.—Fertilizers and manure on SUGARBEETS in sugarbeets-oats-clover rotation. Yield and increase per acre

Plot No.	Treatment per acre, on sugarbeets only	1920—Block I		1921—Block K		10-year average		Plot No.
		Yield Tons	Increase Tons	Yield Tons	Increase Tons	Yield Tons	Increase Tons	
1	None	13.450		9.500		12.601		1
2	Acid phosphate, 600 lb	12.100	— .300	9.800	.250	12.300	—.012	2
3	Muriate potash, 200 lb	10.250	—1.100	8.250	—1.350	10.541	1.483	3
4	None	10.300		9.650		11.736		4
5	Nitrate soda, 200 lb	11.850	.600	10.800	.450	12.967	1.320	5
6	Acid phosphate, 600 lb.; nitrate soda, 200 lb	11.850	—.350	9.600	—1.450	12.829	1.270	6
7	None	13.150		11.750		11.471		7
8	Acid phosphate, 600 lb.; muriate potash, 200 lb	13.000	.700	14.050	1.517	13.509	2.031	8
9	Muriate potash, 200 lb.; nitrate soda, 200 lb	11.100	—.350	12.650	—.667	12.052	.567	9
10	None	10.600		14.100		11.492		10
11	Acid phosphate, 600 lb.; muriate potash, 200 lb.; nitrate soda, 200 lb	13.700	2.208	18.250	4.933	14.696	3.149	11
12	Acid phos., 600 lb.; mur. potash, 200 lb.; nit. soda, 200 lb.; sugar-factory lime, 2 tons	12.450	.067	15.000	2.467	14.163	2.561	12
13	None	13.275		11.750		11.656		13
14	Sugar-factory lime, 2 tons	14.545	2.305	12.150	1.500	11.407*	.933	14
15	Floats, 1,200 lb	13.767	2.563	12.900	3.350	11.689*	1.621	15
16	None	10.169		8.450		10.726*		16
17	Yard manure, 10 tons	12.500	1.276	13.800	4.783	12.972	2.076	17
18	Fresh manure, 10 tons	12.600	.322	13.950	4.367	13.620	2.554	18
19	None	13.333		10.150		11.236		19
20	Fresh manure, 10 tons; sugar-factory lime, 2 tons	13.200	.184	15.600	4.467	13.826	2.086	20
21	Fresh manure, 10 tons; acid phosphate, 300 lb	11.750	—.950	12.300	.167	13.873	1.627	21
22	None	12.383		13.100		13.010*		22
23	Mixed fertilizer, 2-8-2, 500 lb	15.650	1.978	12.900	.717	13.879*	1.238	23
24	Acid phosphate, 287 lb.; muriate potash, 20 lb.; nitrate soda, 52 lb.	17.550	2.589	12.150	.883	14.453*	2.181	24
25	None	16.250		10.350		10.904*		25
26	Acid phosphate, 300 lb.; muriate potash, 100 lb.; nitrate soda, 100 lb	17.250	1.000	11.700	1.350	13.921*	2.017	26
27	Steamed bonemeal, 175 lb.; muriate potash, 100 lb.; nitrate soda, 67 lb	17.850	1.600	11.400	1.050	14.790*	2.856	27
	Average unfertilized yield	12.546		10.978		11.731		
	Average fertilized yield	13,406		12.625		13.274		

*9-year average.

TABLE 13.—Residual effect on OATS of treatment of previous sugarbeet crop in sugarbeets-oats-clover rotation

Plot No.	Treatment per acre, on sugarbeets only	1920—Block L				1921—Block I				10-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	
1	None	73.12	2,210			62.81	1,940			57.39	3,153			1
2	Acid phosphate, 600 lb	62.19	1,910	—6.87	—180	54.37	1,910	—4.59	—20	54.23	2,710	—2.39	—350	2
3	Muriate potash, 200 lb	61.25	1,840	—3.75	—130	52.97	1,805	—2.13	—115	51.92	2,636	—3.91	330	3
4	None	60.94	1,850			51.25	1,910			55.11	2,872			4
5	Nitrate soda, 200 lb	72.79	2,110	9.04	250	55.00	1,790	5.78	—35	55.59	3,228	.89	438	5
6	Acid phosphate, 600 lb.; nitrate soda, 200 lb	62.19	2,260	—4.37	390	51.72	1,695	4.53	—45	56.61	2,973	2.31	266	6
7	None	69.37	1,880			45.16	1,655			53.89	2,624			7
8	Acid phosphate, 600 lb.; muriate potash, 200 lb	76.87	1,990	8.54	193	51.87	1,790	7.23	268	58.17	3,056	5.41	519	8
9	Muriate potash, 200 lb.; nitrate soda, 200 lb	69.37	1,880	2.08	167	45.94	1,430	1.83	42	51.11	2,744	—.51	293	9
10	None	66.25	1,630			43.59	1,255			50.49	2,364			10
11	Acid phos., 600 lb.; mur. potash, 200 lb.; nit. soda, 200 lb.	76.25	2,260	7.71	570	52.50	1,670	7.03	292	56.58	3,089	5.10	600	11
12	Acid phos., 600 lb.; mur. potash, 200 lb.; nit. soda, 200 lb.; sugar-factory lime, 2 tons	80.00	1,690	9.17	—60	54.67	1,600	7.33	98	55.92	2,945	4.05	332	12
13	None	73.12	1,810			49.22	1,625			52.56	2,738			13
14	Sugar-factory lime, 2 tons	69.37	1,780	—1.98	30	53.28	1,795	2.87	123	53.12	2,389	.95	—12	14
15	Floats, 1,200 lb	75.94	1,970	6.36	280	58.53	2,155	6.94	437	55.64	2,942	2.50	355	15
16	None	67.81	1,630			52.78	1,765			53.42	2,511			16
17	Yard manure, 10 tons	79.45	2,235	11.33	515	58.44	2,080	6.64	218	55.06	2,730	2.78	402	17
18	Fresh manure, 10 tons	81.00	1,710	12.56	—100	54.84	2,195	4.02	237	52.80	2,586	.69	200	18
19	None	68.75	1,900			49.84	2,055			51.96	2,445			19
20	Fresh manure, 10 tons; sugar-factory lime, 2 tons	75.31	2,040	3.23	230	59.06	2,060	7.81	50	56.68	2,545	4.23	94	20
21	Fresh manure, 10 tons; acid phosphate, 300 lb	78.44	1,890	3.02	170	57.66	2,105	5.01	140	53.01	2,679	.07	222	21
22	None	78.75	1,630			54.06	1,920			53.43	2,463			22
23	Mixed fertilizers, 2-8-2, 500 lb	84.06	1,760	5.83	113	63.44	2,030	5.16	38	56.37	2,585	3.07	197	23
24	Acid phos., 287 lb.; mur. potash, 100 lb.; nit. soda, 52 lb.	68.44	1,960	—9.27	297	56.87	1,820	—5.63	—243	53.42	2,454	.25	141	24
25	None	77.19	1,680			66.72	2,135			53.04	2,238			25
26	Acid phos., 300 lb.; mur. potash, 100 lb.; nit. soda, 100 lb.	74.37	1,920	—2.82	240	64.53	2,065	—2.19	—70	53.84	2,595	.80	357	26
27	Steamed bonemeal, 175 lb.; mur. pot., 100 lb.; nit. soda, 67 lb	65.00	1,820	—12.19	140	66.72	2,135	0	0	53.09	2,364	.05	126	27
	Average unfertilized yield	70.59	1,802			52.83	1,807			54.20	2,710			
	Average fertilized yield	72.99	1,946			56.24	1,896			61.29	3,195			

TABLE 14.—Residual effect on CLOVER of treatment of previous crops in rotation, Paulding County Experiment Farm. Fertilizing materials and yield and increase of crop in pounds per acre

Plot No.	Fertilizing materials on previous crops					Yield and increase of hay					
						1920		1921		Average	
	Acid phosphate	Muriate potash	Nitrate soda	Lime	Manure	Yield	Increase	Yield	Increase	Yield	Increase
	Rotation I: Corn-oats-wheat-clover					Block C		Block D		8-year average	
1	.....	.....	.....	.....	.....	2,442	.....	3,074	.....	3,846	.....
2	500	.....	.....	.....	.....	2,316	—98	3,411	141	4,254	240
3	500	90	.....	.....	.....	1,811	—575	3,411	—56	4,425	242
4	.....	.....	.....	.....	.....	2,358	.....	3,663	.....	4,351	.....
5	500	90	160	.....	.....	2,147	14	3,368	—225	4,668	286
6	500	90	160	4,000	.....	1,642	—267	3,368	—155	4,482	68
7	.....	.....	.....	.....	.....	1,684	.....	3,453	.....	4,444	.....
8	200	50	50	.....	8 tons	1,937	127	3,958	617	5,076	565
9	520[1]	50	50	.....	8 tons	1,768	—169	3,874	646	4,857	279
10	.....	.....	.....	.....	.....	2,0b3	.....	3,116	.....	4,645	.....
	Average unfertilized yield					2,1?6	.....	3,326	.....	4,321	.....
	Average fertilized yield					1,937	.....	3.565	.....	4,627	.....
	Rotation II: Corn-soybeans-wheat-clover					Block G		Block H		8-year average	
1	.....	.....	.....	.....	.....	2,268	.....	3,200	.....	4,011	.....
2	500	.....	.....	.....	.....	2,268	11	3,537	379	4,737	514
3	500	90	.....	.....	.....	2,063	—180	3,242	126	4,528	93
4	.....	.....	.....	.....	.....	2,232	.....	3,074	.....	4,6487	.....
5	500	90	160	.....	.....	2,684	452	3,116	56	4,558	—36
6	360	90	50	.....	.....	2,232	0	3,368	323	4,799	259
7	.....	.....	.....	.....	.....	2,232	.....	3,031	.....	4,486	.....
8	430	20	50	.....	.....	2,611	367	2,863	—14	4,716	268
9	430	20	50	†	.....	2,189	—67	2,737	15	4,521	111
10	.....	.....	.....	.....	.....	2,268	.....	2,568	.....	4,372	.....
	Average unfertilized yield					2,250	.....	2,968	.....	4,592	.....
	Average fertilized yield					2,341	.....	3,144	.....	4,631	.....

TABLE 14.—Residual effect on CLOVER of treatment of previous crops in rotation, Paulding County Experiment Farm. Fertilizing materials and yield and increase of crop in pounds per acre—Continued

Plot No.	Fertilizing materials on corn					Yield and increase of hay					
						1920		1921		Average	
	Acid phosphate	Muriate potash	Nitrate soda	Lime	Manure	Yield	Increase	Yield	Increase	Yield	Increase
	Rotation III: Sugarbeets-oats-clover					Block K*		Block L		8-year average	
1								2,611		5,113	
2	600							2,821	112	5,304	129
3		200						2,653	—154	5,031	—206
4											
5			200					2,695	—266	5,040	—213
6	600		200					3,032	14	4,876	—331
7								3,074		5,161	
8	600	200						3,284	294	5,244	242
9		200	200					2,821	—84	4,957	116
10								2,821		4,681	
11	600	200	200					2,655	—224	5,735	860
12	600	200	200	4,000				3,326	392	4,660	—410
13								2,990		5,263	
14				4,000				2,779	—323	4,684	—437
15	[2]							2,821	—393	5,607	628
16								3,326		4,837	
17					[3]10 tons			2,863	—323	5,687	742
18					[4]10 tons			2,947	—98	5,199	147
19								2,905		5,159	
20				4,000	[4]10 tons			2,611	—280	4,805	—264
21	300				[4]10 tons			2,990	113	4,970	—10
22								2,863		4,891	
23	[5]							2,737	—98	5,137	334
24	287	100	52					3,032	225	4,788	74
25								2,779		4,626	
26	300	100	100					2,779	0	4,734	108
27	[6]	100	67					2,316	—463	4,718	93
	Average unfertilized yield							2,919		5,008	
	Average fertilized yield							2,840		5,080	

*The clover for 1918 was badly smothered out by the oats of 1917, and that for 1920 failed.

†Catch crop to follow corn.

[1]Including 320 lb. acid phosphate in phosphated manure.

[2]Raw phosphate rock, 1,200 lb. [3]Yard manure. [4]Fresh manure.

[5]Mixed fertilizer (2-8-2) 500 lb. [6]Steamed bonemeal, 175 lb.

[7]Probable error in 1917. 4,431 is the result of using the average of the other 3 weeks for that year.

TABLE 15.—Comparison of oats and soybeans

Treatment	Average yields—Bushels per acre			
	Paulding		Miami	
	Oats	Soybeans	Oats	Soybeans
None	60.99	16.96	46.63	21.31
Phosphorus	58.67	17.23	50.94	24.99
Phosphorus, potassium	62.73	18.06	55.70	25.29
Phosphorus, potassium, nitrogen	63.81	18.43	58.29	23.33

TABLE 16.—Fertilizers, lime, and manure on CORN and OATS grown in 2-year rotation, Paulding County Experiment Farm
Yield and increase per acre

Plot No.	Treatment per acre—all on corn	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
	Corn	Block R				Block Q				7-year average				
1	None	66.50				41.43				50.13				1
2	Acid phosphate, 200 lb	55.00		—13.38		40.71		.47		47.86		— 2.27		2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	80.00		9.74		45.00		5.95		52.14		2.02		3
4	None	72.14				37.86				50.12				4
5	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.	59.29		— 7.85		44.29		7.62		52.38		4.64		5
6	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.; lime, 2 tons	77.14		15.00		46.43		10.95		56.95		11.60		6
7	None	57.14				34.29				42.98				7
8	Untreated manure, 8 tons	73.57		15.71		46.43		11.19		55.47		9.84		8
9	Phosphated manure, 8 tons	67.14		8.57		50.00		13.81		56.78		8.49		9
10	None	59.29				37.14				50.95				10
	Average unfertilized yield	63.77				37.68				48.54				
	Average fertilized yield	68.69				45.48				53.60				
	Oats	Block Q				Block R				6-year average				
1		69.37	1,930			37.66	1,445			56.43	2,144			1
2		77.81	1,910	8.33	100	42.81	1,730	9.01	378	58.12	2,107	3.27	23	2
3		80.94	2,270	11.36	580	34.69	1,240	4.74	— 18	56.21	2,212	2.94	189	3
4		69.69	1,570			26.09	1,165			51.69	1,962			4
5		79.69	2,200	9.90	483	29.69	1,000	4.17	— 100	54.74	2,140	3.40	213	5
6	**No treatment on oats**	78.44	1,890	8.54	27	29.84	1,245	4.90	210	56.33	2,264	5.35	373	6
7		70.00	2,010			24.37	970			50.62	1,855			7
8		69.69	1,670	— 1.25	— 360	23.75	1,140	— 1.04	100	56.35	2,138	4.62	188	8
9		72.50	1,930	.63	— 120	22.03	745	— 3.17	— 365	54.82	2,346	1.97	301	9
10		72.81	2,070			25.62	1,180			53.95	2,140			10
	Average unfertilized yield	70.74	1,895			28.44	1,190			53.23	2,025			
	Average fertilized yield	76.51	1,978			30.47	1,183			56.10	2,201			

TABLE 17.—Lime, gypsum, sulphur, and fertilizers on 4-year rotation of corn, soybeans, wheat, and clover, Paulding County Experiment Farm, 1921

Plot No.	Treatment per acre on corn, soybeans and wheat				Yield and increase per acre										Plot No.
					Corn, Block W		Soybeans, Block X				Wheat, Block Y				
					Grain only		Grain		Straw		Grain		Straw		
	Gypsum	Hydrated lime	Sulphur	Fertilizer*	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	
1	.....	.....	.....	.....	32.86	.....	21.67	.....	2,400	.....	10.00	.....	1,800	.....	1
2	1,000	.....	.....	.....	35.71	3.33	19.33	—1.12	3,240	667	11.33	.22	1,120	—613	2
3	1,000	.....	.....	175	28.37	—3.34	18.67	—.75	3,480	733	15.67	3.45	1,660	—7	3
4	.....	.....	.....	.....	31.43	.....	18.00	.....	2,920	.....	13.33	.....	1,600	.....	4
5	.....	4,000	.....	.....	40.00	8.57	19.00	2.89	2,860	293	15.00	1.45	1,700	280	5
6	.....	4,000	.....	175	38.57	7.14	13.67	—.55	2,180	—33	16.33	2.55	1,620	380	6
7	.....	.....	.....	.....	31.43	.....	12.33	.....	1,860	.....	14.00	.....	1,060	.....	7
8	.....	.....	500	.....	28.57	—5.72	16.67	2.34	2,400	460	15.33	—.11	1,180	—93	8
9	.....	.....	500	175	44.29	7.15	19.00	2.67	2,260	240	15.67	—1.22	1,360	—127	9
10	.....	.....	.....	.....	40.00	.....	18.33	.....	2,100	.....	18.33	.....	1,700	.....	10
11	.....	.....	.....	175	21.43	—18.57	19.33	1.00	2,040	—60	20.00	1.67	1,800	100	11
Average unfertilized yield					33.93	.....	17.95	.....	2,320	.....	15.62	.....	1,491	.....	

*Made up of nitrate of soda, 25 pounds; dried blood, 50 pounds; steamed bonemeal, 200 pounds.

TABLE 18.—Ground limestone vs. sugar-factory lime on ALFALFA
Yield per acre

Year	No lime	Ground limestone	Sugar-factory lime
1918	1,687	1,687	1,687
1919	3,609	3,047	2,953
1920	7,828	7,219	4,687
1921	6,863	5,853	4,379
Average	4,997	4,451	3,426

TABLE 19.—Fertilizers, manure, and lime on SUGARBEETS, Paulding County Experiment Farm. Financial outcome

Plot No.	Fertilizing materials per acre					Total cost of treatment	Total value of increase	Net gain or loss (—)
	Acid phosphate	Muriate potash	Nitrate soda	Lime	Manure			
	Lb.	*Lb.*	*Lb.*	*Tons*	*Tons*	*Dollars*	*Dollars*	*Dollars*
2	600					6.00	— 0.23	—5.77
3		200				6.00	6.52	0.52
5			200			6.00	7.16	1.16
6	600		200			12.00	6.74	—5.26
8	600	200				12.00	15.20	3.20
9		200	200			12.00	3.81	—8.19
11	600	200	200			18.00	24.89	6.89
12	600	200	200	2		24.00	14.66	—9.34
14				2		6.00	3.72	—2.28
15	1					9.00	13.70	4.70
17					10[2]	10.00	17.10	7.10
18					10[3]	10.00	16.28	6.28
20				2	10[3]	16.00	12.60	—3.40
21	300				10[3]	19.00	9.73	—9.27
23	4					7.00	10.12	3.12
24	250[5]	20	52			4.66	13.54	8.78
26	300	100	100			9.00	12.91	3.91
27	6	100	67			8.50	17.62	9.12

[1]Raw rock phosphate, 1,200 pounds.
[2]Yard manure.
[3]Fresh manure.
[4]Mixed fertilizer, 2-8-2, 500 pounds.
[5]Equivalent to 2-8-2, 500 pounds.
[6]Steamed bonemeal, 175 pounds.
The dressings on Plots 23 and 24 are calculated to carry equivalent amounts of the three fertilizing elements, also those on Plots 26 and 27.

Fertilizers, lime, and manure on sugarbeets.—The sugarbeet crop is a difficult one with which to experiment on account of the difficulty in securing an even stand, and there is considerable irregularity in the results obtained from year to year in this experiment. The average outcome indicates that acid phosphate when used alone has diminished the yield; but this is partly due to the comparison with Plot 1, which has regularly given a relatively large yield. This plot in each section lies nearest the large open ditch shown in the plan on page 357.

SUGAR FACTORY LIME VS. GROUND LIMESTONE

The question whether the unfavorable effect of liming in these experiments is due to the carrier of lime employed is being studied in an experiment with alfalfa, begun in 1918, in which sugar-factory lime and ground limestone are each used at the rate of 1000 pounds per acre, applied at the time of seeding.

It would appear that the addition of lime in any form is detrimental on this soil. A further study of this question, however, as also of the effect of sulphur, is being undertaken in an experiment in which corn, soybeans, wheat, and clover are grown in a 4-year rotation under the treatments shown in Table 17, which gives the results of the first year's work. These results are as yet too contradictory to have any significance, and are merely given as a matter of record. Experiments of this kind seldom have any value before the second rotation is completed.

Table 19 shows the apparent financial outcome in this experiment, computing beets at $6.00 a ton, over and above the cost of harvesting; oats at 33⅓ cents a bushel; hay at $10.00 a ton; acid phosphate at $20.00 a ton; rock phosphate at $15.00 a ton; muriate of potash and nitrate of soda each at 3 cents a pound; sugar-factory lime at $3.00 a ton; and manure at $1.00 a ton—all spread on the field.

Apparently acid phosphate has produced no increase in yield when used alone, while the raw rock phosphate seems to have been used with profit. Muriate of potash and nitrate of soda, when used alone, have returned their cost with a small balance. The combination of acid phosphate and nitrate of soda gives practically the same gain as that from the nitrate used alone, while the combination of acid phosphate and muriate of potash gives a profitable increase. This is the first outcome in the series that is in harmony with results attained on other Ohio soils. The Paulding County soil is the only one thus far tested in which acid phosphate has failed to produce a large increase of yield, whether used alone or in combination.

The low yield of Plot 9, from the combination of nitrate of soda and muriate of potash, is in harmony with results elsewhere, as is the great increase on Plot 11, following the addition of acid phosphate to this combination.

The sugar-factory lime appears to have reduced the yield wherever used. This effect has been so marked as to be evident in the growing clover, just where liming shows the greatest benefit on other soils.

Manure used alone has produced a profitable increase when its cost on the field is rated at not exceeding a dollar to a dollar and a half a ton; but the addition of either lime or acid phosphate seems to have reduced the effectiveness of the manure, results again contradictory to those attained elsewhere.

The factory mixed fertilizer used on Plot 23 has produced a profitable increase over its estimated cost of $28.00 a ton; but the duplicate home mixture, used on Plot 24, has cost so much less that the net gain is more than twice as great.

Bonemeal, like the raw phosphate, appears to be a more effective carrier to this soil than acid phosphate, as shown by comparing plots 26 and 27, results again contradictory to those attained elsewhere.

It would seem that the three leading elements of fertility—phosphorus, potassium, and nitrogen— are so evenly balanced in this soil that in order to produce any marked increase in yield it is necessary to add all three, either in a complete fertilizer or in manure. Apparently lime is already in excess, and also sulphur, judging from the behavior of acid phosphate, as compared with rock phosphate and bonemeal.

Visitors' Day, Paulding County Experiment Farm

COMPARISON OF VARIETIES

DEPARTMENT OF AGRONOMY

CORN

Nine varieties of corn have been tested on the Paulding County Experiment Farm for a period of nine years, except as noted in Table 20. These varieties differ much in maturity. For a comparison of the yields of ear-corn the four varieties, White Cap, Leaming P. D., Clarage (Wheeler), and Ohio 84 make up a group of well matured sorts, of which Leaming P. D. is first and Clarage second. Although White Cap has a record of only 51.15 bushels per acre, it has been fully matured and sound each year. The remaining varieties are later maturing and the ear-corn carries a large amount of moisture at husking time which should be considered in comparing this group with the first one. Cook's 75 leads this group, with Reid (Wheeler) second, and Reid (Orcutt) third.

TABLE 20.—Varieties of CORN. Yield per acre

Variety	1920	1921	9-year average*	
			Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Lb.*
Reid (Morisy)	61.19	.....	55.92	4,117†
Reid (Orcutt)	79.41	53.93	61.07	3,850
Reid (Wheeler)	81.37	.....	62.35	3,704
Cook's 75	85.30	61.61	65.03	3,721
Ohio 84	63.70	46.79	56.08	3,196
Clarage (Wheeler)	65.30	54.46	58.89	3,251
Leaming P. D.	65.66	51.96	59.74	3,267
Darke Co. Mammoth	79.05	50.00	60.46	3,854
White Cap	64.05	42.15	51.15	2,664†

*The yields of corn, oats, wheat, and soybeans for the individual years prior to 1920 are given in Bulletin No. 344, Part 2.

†6-year average.

A five-year test of planting corn at the three rates of two, three, and four plants per hill has averaged 54.57 bushels per acre for 2 plants, 57.43 bushels for 3 plants, and 58.28 bushels for 4 plants.

OATS, BARLEY, AND SPRING WHEAT

Eight varieties of oats, one of barley, and one of spring wheat have been tested for a 10-year period, except as noted in Table 21 Ohio 6222, a selection from the Improved American, has the highest average yield, and Big Four the second. Barley has yielded fairly well, its yield of 33.26 bushels being equal to a yield of 49.9 bushels of oats. Barley and spring wheat suffer greatly from the attacks of chinch bugs, which are a serious pest in northwestern Ohio.

TABLE 21.—Varieties of OATS. Yield per acre

Variety	1920	1921	10-year average*	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Big Four	81.84	47.16	64.93	2,435
Silver Mine	79.81	43.49	58.74	2,419
Swedish Select	77.54	28.02	56.36	2,487
Little White (local)	69.35	48.48	63.00	2,724*
Ohio 7009	.....	.....	54.94	1,877**
Miami (Ohio 6203)	57.62	41.06	57.75	2,281
Ohio 6222	86.61	42.08	67.05	2,852
Wideawake	62.39	31.14	51.31	2,722
Oderbrucker barley	35.42	6.67†	33.26	2,093‡
Spring wheat	11.17	8.33†	8.72	1,493§

*9-year average.
**6-year average.
†Damaged by chinch bugs.
‡8-year average.
§3-year average.

WINTER WHEAT

Wheat in Paulding County is giving way in large measure to oats because of frequent winter-killing and damage by chinch bugs. Wheat has been grown on the Paulding County farm since 1913. In 1916 the crop was a failure because of winter-killing and in 1917 the yield was much reduced from the same cause. In spite of this, the 8-year average yields as reported in Table 22 are encouraging. Trumbull leads with an average of 30.21 bushels per acre, followed by Turkey Red, Gladden, and Portage, in order.

TABLE 22.—Varieties of WHEAT. Yield per acre

Variety	1920	1921	8-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Nigger	10.17	10.72	26.21	2,796
Gladden	12.09	20.30	28.44	3,412
Mediterranean	9.50	.....	24.93	2,849*
Rudy	11.26	20.14	27.18	2,887
Turkey Red	13.33	23.34	29.53	3,412
Trumbull	13.34	18.97	30.21	3,265
Portage	12.50	15.43	27.40	2,956
Goens	12.00	.....	25.56	3,653†
Velvet Chaff	11.17	12.55	25.54	3,199

*7-year average.
†6-year average.

SOYBEANS

The variety test of soybeans has demonstrated the impracticability of growing late-maturing sorts for seed production. Elton leads in yield of grain, with 18.58 bushels per acre; and is as late in maturing as is safe to grow. Ohio 9100, a selection of Ito San, matures early enough to escape killing frosts in most seasons.

TABLE 23.—Varieties of SOYBEANS. Yield per acre

Variety	1913	1914	1915	1917	1918	1919	1920	1921	Average yield	
									Grain	Str'w
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.**	*Bu.*	*Bu.*	*Lb.*
Medium Green	13.67	13.79	.....	13.70	7.33	8.00	10.08	18.41	12.14	1,550
Elton	28.49	21.51	26.00	17.14	12.43	18.67	14.52	9 88	18.58	1,727
Hamilton (Ohio 9035)	20.98	23.87	13.33	frosted	5.53	17.50	10.62	26.34	16.88	2,003
Ohio 7496	19.17	20.73	7.50	12.50	6.96	17.00	.....	.....	13.98	1,442
Ohio 9100 (Ito San)	22.38	15.18	12.17	16.02	13.39	12.67	17.15	17.11	15.76	1,582
Mongol	19.21	15.54	.....	.....	.....	.....	.....	.....	17.37	.....
Ebony	20.34	15.95	.....	.....	.....	.....	.....	.....	18.14	.....
Ohio 9016	16.77	18.24	15.08	.....	.....	.....	11.55	11.15†	14.56	1,597

*Badly shattered.
†Poor stand.

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BULLETIN

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COUNTY EXPERIMENT FARMS IN OHIO

PART III

THE CLERMONT COUNTY EXPERIMENT FARM

NINTH AND TENTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

W. E. WEAVER, SUPERINTENDENT
H. S. ELLIOTT, FOREMAN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$ 6,500.00	$ 6,500.00
Permanent improvements made to March 1	6,771.42	7,785.45
Permanent improvements made during year ended March 1, 1921: Finishing new house, $302.23; drainage, $702.74; water system, $5.85; plantings, $1.51; gravel, $1.70—total	1,014.03	
March 1, 1922: Drainage, $1,682.20; plantings, $21.18; sidewalks, $24.32—total		1,727.70
Total permanent investment	$14,285.45	$16,013.15
Operating equipment:		
Livestock:		
March 1, 1921: 4 horses, $550; 12 sheep, $85; 198 chickens, $495—total	$ 1,130.00	
March 1, 1922: 4 horses, $500; 11 sheep, $60; 148 chickens, $222—total		$ 782.00
Machinery, tools, and harness	1,116.50	1,682.50
Crops, feeds, and seeds:		
March 1, 1921: corn, $260; oats, $2.50; potatoes, $8; straw, $15; soyhay, $75; mixed hay, $150; wheat, $85; mill feed, $20; meat scraps, $4; grass seed, $74; soybeans, $350—total	1,043.50	
March 1, 1922: corn, $336; oats, $2; wheat, $9; hay, $264; straw, $18; soybeans, $180; potatoes, $2; mill feed, $15; grass seed, $55—total		881.00
Fertilizer and lime 1921, fertilizer 1922	21.00	138.00
Drain tile	152.00	
Containers	7.50	7.00
Spray material	14.00	42.00
Sundries:		
Gasoline	7.00	
Cement, $6; paint, $17		23.00
Total operating equipment	$ 3,491.50	$ 3,555.50
Total investment	17,776.95	19,568.65

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Receipts

	1920	1921
From County Maintenance fund	$ 1,912.09	$ 1,956.71
From Farm sales:		
Livestock and products:		
1920—Sheep, $82.25; poultry, $141.25; eggs, $578.48—total	801.98	
1921—Sheep, $67.64; poultry, $24; eggs, $460.67; wool, $19.23—total		571.54
Crops:		
1920—Corn, $209.41; oats, 80c; soybeans, $202.50; hay, $191; wheat, $335; apples, $335.89; peaches, $156.59—total	1,431.19	
1921—Corn, $80.99; wheat, $510.26; soybeans, $106.50; apples, $120.15; potatoes, $5.50—total.		945.62
Sundries:		
1920—Machinery hire, $2.25; rent of land, $30; refund for fertilizer, $117—total	149.25	
1921—Machinery hire, $5.70; rent of land, $30; refund on fertilizer, $30.81; labor, $10; telephone tolls, 90c; refund on plow, $5; scale drafts 45c—total		82.86
Total receipts	$ 4,294.51	$ 3,556.73
Balance forward March 1	1,513.59	1,128.69
	$ 5,808.10	$ 4,685.42

Expenditures

For labor	$ 1,835.45	$ 2,054.18
For current expenses	1,004.18	791.60*
For permanent improvements:		
1920—Building material, $302.23; drainage, $702.74; water system, $5.85; plantings, $1.51; gravel, $1.70—total	1,014.03	
1921—Drainage, $737.96; concrete, $14.88; plantings, $13.94—total		766.78
For machinery and tools	90.75	177.68
For livestock: Horse, $125; sheep, $10; poultry, $600...	735.00	
Total expense	$ 4,679.41	$ 3,790.24
Balance carried forward	1,128.69	895.18
	$ 5,808.10	$ 4,685.42

ITEMIZED CURRENT EXPENSES

	1920	1921		1920	1921
Seeds	$ 195.65	$107 55	Feed	$ 133.06	$ 99 09
Fertilizer	449.48	292 73*	Horse-shoeing	21.25	30 70
Spray material	39.73	48 77	Livestock equipment	3 85	12.51
Containers	.50	1.80	Communication	27.50	30.80
Livestock incidentals	3.59	4.15	Publicity	28.80	22 05
Building maintenance	1.94	25.97	Scale drafts	.60	
Fence maintenance	1.42	.25	Miscellaneous hard're	6.38	6.37
Implement repairs	69.70	32.31	Veterinary		4.80
Water supply maintenance	.38	2.20	Transportation		1.00
Engine maintenance	12.75	13.50	Gasoline and oil		41.05
Binder twine	7.60	14.00	Total	$1,004.18	$791.60

*Of this amount $12 was for fertilizer for 1922.

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of Farm in Acres	1920	1921
Cultivated	75.25	73.55
Farmstead	4.96	4.96
Pasture	11.49	12.49
Orchard	11.58	11.67
Woodlot	13.19	13.87
Roads (public)	.77	.77
Roads (farm)	10.08	10.02
Waste	2.89	2.88
Total	130.21	130.21

Plot Work	1920			1921		
	Number of plots	Acres	Yield per acre	Number of plots	Acres	Yield per acre
Corn	57	7.45	38.4 bu.	69	8.55	42.4 bu.
Oats	9	1.00	37.0 bu.	12	1.05	22.8 bu.
Soybeans	41	5.56	19.6 bu.	37	5.05	12.2 bu.
Barley	1	.10	9.1 bu.	1	.10	5.4 bu.
Potatoes	10	.50	21.7 bu.	10	.50	12.8 bu.
Wheat	47	5.80	12.4 bu.	56	6.08	16.3 bu.
Hay (clover)	40	3.28	1.3 tons	30	2.00	1.3 tons
Hay (soy)	9	.45	1.9 tons	6	1.20	.9 ton
Soybeans (forage)				10	.27	1.8 tons
Total	214	24.14		231	24.80	
Field Work						
Corn		7.00	40.8 bu.		7.37	45.3 bu.
Wheat		9.00	15.3 bu.		19.08	18.6 bu.
Hay (mixed)					6.34	1.1 tons
Hay (clover)		10.84	1.4 tons		7.00	2.0 tons
Soybeans		4.38	7.2 bu.		4.50	8.1 bu.
Soybeans					1.00	disced in
Hay (soy)		7.00	2.0 tons		3.50	1.8 tons
Soybeans (forage)						
Potatoes						
Unharvested area		12.88				
Total		51.1			48.79	

	Corn	Oats	Wheat	Soybeans	Potatoes	Clover hay	Soybean hay
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Highest plot yield per acre 1920	67.5	49.0	31.6	26.3	57.6	2.8	2.5
Highest plot yield per acre 1921	69.8	30.0	26.6	20.3	37.0	2.7	2.0
Lowest plot yield per acre 1920	3.4	29.6	1.5	6.1	3.3	.2	.9
Lowest plot yield per acre 1921	2.7	6.9	4.6	5.5	4.0	.4	.2

	1920	1921
Number of work horses	4	4
Number of crop acres per work horse	18.8	18.3
Hours of man-labor, year beginning March 1	6,923	8,009
Hours of horse-labor, year beginning March 1	3,972	5,178

TABLE 1.—COST OF PRODUCTION AND RETURN PER ACRE OF CROPS IN ROTATION, 1921

Interest on investment, machinery, and overhead charges not considered

Crops	Labor costs*						Fertilizer costs	Miscellaneous costs†	Total cost	Yield	Gross returns	Net returns
	Growing			Harvesting								
	M. H.	H. H.	Cost	M. H.	H. H.	Cost						
Corn cut and husked	21.4	39.7	$13.47	45.8	23.1	$16.23	$5.95	$ 7.26	$36.96	46.1 bu.	$31.02	$—5.94
Corn husked from stalk	27.0	45.8	16.22	16.0	19.8	8.21	3.60	5.00	29.43	50.8 bu.	27.97	—1.48
Wheat	8.5	16.6	6.08	11.7	8.0	4.85	9.23	16.14	27.07	21.0 bu.	25.85	—1.22
Hay (clover)	1.85	2.43	1.12	7.28	6.0	3.60	1.10	7.62	12.34	2.06 tons	22.63	10.29
Hay (soybean)	11.8	24.5	7.88	11.7	10.3	5.24	7.34	11.84	24.96	1.97 tons	21.67	—3.30
Soybeans	20.8	33.5	12.08	8.5	5.1	3.40	7.34	13.81	29.29	7.89 bu.	24.58	—4.71

*The man-hour (M. H.) rate of 29 cents is found by dividing the total value of wages and perquisites by the number of hours of labor performed on a yearly basis; the horse-hour (H. H) rate of 18 cents, by dividing the total value of feeds, care, maintenance, and miscellaneous costs by the number hours of labor.

†Miscellaneous costs include fertilizer, twine, lime, threshing, and seed.

REPORT OF WORK FOR THE YEARS 1920 AND 1921

W. E. WEAVER

FIELD CROPS

A 4-year rotation of corn, soybeans, wheat, and clover has been continued on four 7-acre fields. One-half the soybean field is drilled solid and cut for hay, the other half is drilled in rows, cultivated, and harvested for grain. The corn is cut and rye sown for a cover crop. Three of the fields are drained. Table 1 shows the labor, miscellaneous costs, and net returns for 1921. Clover, although it sometimes fails on this farm, is the only crop that gave a net profit. Crops are computed at harvest-time values, fertilizers at market prices, man-labor at 29c and horse-labor at 18c per hour.

TABLE 2.—COST AND RETURN PER ACRE OF DIFFERENT ROTATIONS

	Four-year rotation: Corn, soybeans, wheat, clover		Cow-feed rotation: Corn, peas, oats, vetch, soybeans hay		Three-year rotation: Corn, soybeans, wheat (Plot 5)	
Man-hours	31.4	$ 9.64	55.8	$16.53	31.56	$ 9.10
Horse-hours	33.6	6.66	73.6	13.57	42.63	7.67
Miscellaneous costs	.....	15.02	.....	23.90	.....	13.40
Total cost	.....	$31.32	.....	$54.00	.....	$30.17
Value of crops	.....	26.79	.....	23.79	.....	33.00
Balance	.....	$—4.53	.....	$—30.21	.....	2.83

Table 2 gives a comparison of labor and miscellaneous costs of crops grown in three rotations in 1921, reduced to a one-acre, one-year basis. A four-year rotation of corn, soybeans, wheat, and clover; and a two-year "Cow-feed" rotation of corn for silage, followed the next year by a mixture of Canada field peas, oats, and vetch to be cut for hay, after which soybeans are sown immediately for hay or forage; and a three-year rotation of corn, soybeans, and wheat, (Plot 5).

The three-year rotation made the best showing and with some modifications is probably well adapted to many Clermont County farms. The "Cow-feed" rotation, while producing good crops, is expensive and requires plowing every year. The land seems to produce better if given one year in the rotation free from cultivation.

The loss shown in the 4-year as compared with the 3-year rotation is due in part to the greater value of soybean seed in the latter rotation than of soybean hay in the former.

ORCHARD WORK

The apple orchards, set in 1911, gave the following yields in 1920 and 1921, in pounds per acre:

TABLE 3.—VARIETY AND CULTURAL TEST OF APPLES

Variety	No.	Sod mulch		Cultivated		Total	Average per tree
		1920	1921	1920	1921		
Gano	20	942	44	1,216	63	2,265	113
Rome Beauty	40	203	218	1,388	389	2,198	55
Jonathan	40	487	552	897	1,006	2,942	74
Grimes Golden	20	717	42	113	108	980	49
Stayman Winesap	20	224	8	938	113	1,283	64
York Imperial	20	119	64	546	59	788	39
Total	160	2,692	928	5 098	1,738	10,456	65

The annual costs and receipts to 1919 are given in Bulletin 344, part 3. The cost per tree for the ten years under sod mulch was $4.52; under cultivation, $6.87. The return per tree in sod mulch was $1.52; under cultivation—including sale of three soybean crops amounting to 20 cents per tree—was $4.49; or the net cost per tree for the first ten years is $3.00 in sod mulch and $2.38 under cultivation.

TABLE 4.—FINANCIAL SUMMARY OF ORCHARD WORK

	Apple orchards						Peach orchard	
	Sod mulch, 160 trees		Cultivated, 160 trees		Variety, 72 trees		306 trees	
	Cost	Receipts	Cost	Receipts	Cost	Recipts	Cost	Receipts
1912–1919	$495.44	$98 67	$749.69	$346.10	$512.84	$161.25	$433.47	$ 74.93
1920	126.19	94.25	208.75	184.61	85.57	85.40	58.63	130.00
1921	102.99	50.60	141.55	97.90	72.85	.....	78.35	.....
Total	$724.62	$243.52	$1 099.99	$628.61	$671.26	$246.65	$570.45	$204.93

Two crops of peaches have been harvested; one in 1919 valued at $49.93 and one in 1920 at $130.00. To this may be added a crop of potatoes in 1914 valued at $25.00, making the average receipts per tree 67 cents. The average cost per tree to date is $1.84.

The peach orchard has given such poor results that all but 20 of the trees have been taken out.

Varieties of plums, cherries, and grapes have been added.

IMPROVEMENT

With the exception of Field 4 and the range of plots which is to be left undrained for comparison, the drainage of the cultivated

area has been practically completed. The itemized account, Table 5, for Fields 5 and 6 will fairly illustrate the cost of tiling on this farm.

TABLE 5.—COST OF TILE DRAINAGE, FIELDS 5 AND 6

	Man hours	Value	Horse hours	Value	Total value
Laying out ditches at 60 cents per hour	10.5	$ 6.30	.....	.....	$ 6.30
Operating ditcher at 70 cents per hour	22.0	15.40	.....	.....	15.40
Gasoline, 35 gallons at 21 cents per gallon	.....	.....	.....	.....	7.35
Oil and grease	.....	.....	.....	.....	.75
Rent of ditcher, 478.6 rods at 30 cents per rod	.....	.....	.....	.....	143.58
Cleaning ditches at 40 per hour	10.5	4.20	.....	.....	4.20
Distributing tile, (man hrs. at 33 cents horse hrs. at 20 cts.	22.5	7.43	4.50	$9.00	16.43
371 6-inch tile, 23.2 rods, at $1.49 per rod	.....	34.57	.....	.....	.....
7,263 4-inch tile, 453.9 rods, at 93.3 cents per rod	.....	423.49	.....	.....	.....
1 6-inch sewer Y	.....	1.10	.....	.....	.....
1 4-inch sewer L	.....	.85	.....	.....	.....
20-4×6 holes at 70 cents each	.....	14.00	.....	.....	474.01
Filling ditches	.....	.....	.....	.....	40.88
Measuring and counting ditch and tile, at 60 cts. per hour	4.5	2.70	.....	.....	2.70
Overhead charges, 478.6 rods at 2.4 cents per rod	.....	.....	.....	.....	10.49
Total cost	.....	.....	.....	.....	$722.09
Cost per rod (478.6 rods)	.....	.....	.....	.....	1.58
Cost per acre (8.6 acre)	.....	.....	.....	.....	83.96

Note: This work included 40 laterals, 48 and 60 feet apart, and one main for for outlet.

No other permanent improvements have been made except finishing the new house. A two-way plow, farm wagon, cultipacker, and power sprayer have been added to the farm equipment. A car of 52.3 tons of ground limestone was purchased from the Ohio Penitentiary at $2.90 per ton delivered to Gernon siding, 4 miles from the farm.

POULTRY WORK

D. C. KENNARD

The poultry work at the Clermont County Experiment Farm has been continuous for the past five years under the management of the same foreman so that the care of the birds has been consistent and uniform. However, it was a period of extremes in feed, labor, and egg prices.

The pullets produced a larger average number of eggs than the two-year-old hens but the hens made a better interest rate on the average investment, and a slightly greater profit per bird over feed cost. This inconsistent result was due to the deflation of prices. The pullets, bought in 1920 at $3 per bird underwent a double depreciation during the year, due to the lowering of prices and to change from pullets to yearling hens. Hence the small net profit over all expenses was inevitable.

Summaries of feed and labor costs and receipts from eggs covering the different seasons of the year are given in Table 6.

TABLE 6.—SEASONAL AND YEARLY EGG PRODUCTION, GROSS RETURNS, AND INCOME OVER FEED AND LABOR COSTS PER BIRD

Pullets or hens	Number of eggs per bird				Pounds of feed	Cost of feed	Cost of labor	Income from eggs			Feed and labor cost per dozen eggs	Av. price per dozen eggs	Profit or loss (—) per dozen eggs*
								Gross	Over feed cost	Over feed and labor costs			
Winter													
	November	December	January	Total									
Hens, 1-year, 1917	.6	.4	1.8	2.8	12.9	$0.26	$0.11	$0.08	$—0.18	$—0.29	$1.58	$0.37	$-1.21
Pullets, 1918	.3	5.6	11.3	17.2	17.4	.43	.16	.61	.18	.02	.408	.545	.137
Hens, 1919	.5	.4	3.3	4.2	15.4	.43	.21	.10	—.33	—.54	1.82	.....	.....
2-year Hens, 1920	.1	.0	.7	.8	11.3	.37	.27	.04	—.33	—.60	9.51	.68	—8.83
Pullets, 1921	3.2	6.1	10.7	20.0	15.9	.35	.17	.87	.52	.35	.312	.61	.298
Average Pullets	1.75	5.85	11.00	18.6	16.6	$ .39	$ .165	$ .74	.35	.185	.358	.575	$ .217
Average Hens	.40	.27	1.93	2.6	13.2	.35	.20	.07	—.28	—.48	2.53	.525	—2.005
Spring													
	February	March	April	May	Total								
Hens, 1 year, 1917	5.3	15.7	19.2	18.5	58.7	23.5	$0.59	$0.15	$1.40	$ .81	$0.66	$0.15	$0.33	$0.18
Pullets, 1918	11.5	20.9	20.9	20.7	74.0	27.3	.73	.22	2.17	1.42	1.22	.15	.35	.20
Hens, 1-year, 1919	8.1	18.2	20.7	21.0	68.0	25.5	.71	.28	2.13	1.44	1.14	.17	.38	.21
2-year Hens, 1920	4.1	14.9	18.4	19.2	56.6	25.1	.82	.34	1.70	.88	.54	.24	.41	.17
Pullets, 1921	12.9	20.9	20.6	19.9	74.3	23.7	.42	.23	1.46	1.04	.81	.10	.24½	.14½
Average Pullets	12.2	20.9	20.75	20.3	74.15	25.5	$0.575	$0.225	$1.815	$1.24	$1.015	$.128	$.297	0.169
Average Hens	5.8	16.3	19.4	19.6	61.1	24.7	.70	.26	1.74	1.04	.78	.188	.37	.182

TABLE 6.—SEASONAL AND YEARLY EGG PRODUCTION, GROSS RETURNS, AND INCOME OVER FEED AND LABOR COSTS PER BIRD—Continued

Pullets or hens	Number of eggs per bird						Pounds of feed	Cost of feed	Cost of feed	Income from eggs			Feed and labor cost per dozen eggs	Av. price per dozen eggs	Profit or loss (—) per dozen eggs
										Gross	Over feed cost	Over feed and labor cost			
Summer															
	June	July	August	Sept.	October	Total									
Hens, 1-year, 1917	15.8	13.9	7.3	4.9	3.3	45.2	24.0	$0.61	$0.20	$1.22	$0.61	$0.41	$0.22	$0.30	$0.08
Pullets, 1918	14.0	14.1	10.8	9.9	.3	49.1	21.9	.64	.30	1.51	.87	.57	.23	.36	.13
Hens, 1-year, 1919	17.3	15.6	10.9	6.8	4.4	55.0	21.9	.70	.36	2.05	1.35	.99	.23	.46	.23
Hens, 2-year, 1920	16.3	13.9	11.2	3.4	1.8	46.6	20.8	.73	.43	1.72	.99	.56	.29	.33	.04
Pullets, 1921	15.3	13.8	15.5	7.3	.7	52.6	23.4	.42	.32	1.19	.77	.45	.17	.33	.16
Average Pullets	14.65	13.95	13.15	8.60	.50	50.85	22.65	$0.53	$0.31	1.35	$0.82	$0.51	$0.19	$0.345	$0.155
Average Hens	16.46	14.46	9.80	5.03	3.16	48.93	22.23	.68	.33	1.66	.98	.65	.25	.363	.113
Year															
Hens, 1-year, 1917	106.7						60.4	$1.46	$0.46	$2.70	$1.24	$0.78	$0.22	$0.33	$0.11
Pullets, 1918	140.3						66.6	1.80	.68	4.29	2.49	1.81	.20	.42	.22
Hens, 1-year, 1919	127.2						62.8	1.84	.85	4.28	2.44	1.59	.25	.39	.14
Hens, 2-year, 1920	104.0						57.2	1.92	1.04	3.46	1.54	.50	.33	.47	.14
Pullets, 1921	146.9						63.	1.19	.72	3.53	2.33	1.61	.16	.39	.23
Average pullets	143.6						64.8	$1.495	$ .70	$3.905	$2.41	$1.71	$ .18	$ .405	$ .225
Average hens	112 635						60.13	1.74	.78	3.48	1.74	.96	.26	.40	.14

The farmer derives no advantage from the high price of eggs during the winter if he has none to sell. If egg production were large at this season, prices would not be high. To any consumers who may think that farmers profit at their expense from the high price of winter eggs, results for five years as shown in Table 6 will be of interest. The pullets showed a profit over feed and labor costs of 22 cents per dozen eggs and the hens showed a loss of $2 per dozen eggs. More winter eggs should have been produced by the pullets as they were a good grade of well matured Leghorn pullets and were well fed and cared for with the exception that they received no green feed during the winter months. This may account for the low egg production during this period. From the tables it is evident that the main profit derived from the hens or pullets came from the lower priced eggs of spring, summer, and fall. For farm poultry keepers a price of 5 or 10 cents a dozen more for eggs during the laying season is better than the highest possible price during the winter months.

SUMMARIES OF POULTRY WORK

DEBITS		CREDITS	
Inventory October 1, 1919		Inventory September 25, 1920	
Land	$ 100.00	Land	$ 100.00
Buildings and equipment	190.00	Buildings and equipment	192.00
125 hens	130.00	Receipts:	
Expenses:		Eggs sold	367.02
Feed used	247.24	Eggs used	76.08
Man-labor	124.90	Manure	6.20
Horse-labor	7.20	113 hens sold	141.25
To balance (profit)	83.21		$ 882.55
Totals	$ 882.55	Inventory October 1, 1921	
Inventory September 18, 1920		Land	$ 100.00
Land	$ 100.00	Buildings and equipment	190.00
Buildings and equipment	194.00	Supplies	1.55
200 pullets	600.00	150 hens	300.00
Expenses:		Receipts:	
Feed used	243.39	Eggs sold	650.79
Man-labor	136.15	Eggs used	56.47
Horse-labor	8.08	Poultry sold	24.00
To balance (profit)	58.54	Manure	17.35
	$1,340.16		$1,340.16

	1920	1921
Average number of hens for the year	124	175
Total number of eggs	13,092	27,775
Average number of eggs per hen	105.6	158
Gross returns per hen	$4.77	$4.28
Feed cost per hen	$1.98	$1.36
Labor cost per hen	$1.06	$0.82
Profit over feed cost per hen	$2.79	$2.92
Profit over feed and labor cost per hen	$1.73	$2.10
Net profit per hen	$0.67	$0.33
Average selling price of eggs per dozen	$0.407	$0.31
Number of hours of man-labor per hen	3.05	2.55
Average Prices		
Corn, shelled or cracked, per cwt.	$3.02	$1.47
Bran per cwt.	2.81	1.94
Meat scraps per cwt.	6.20	5.08
Oilmeal per cwt.	4.50	3.42
Oyster shells per cwt.	1.37	1.35
Man-labor per hour	0.33	0.29
Horse-labor per hour	0.20	0.18

Not counting overhead expenses, the balances show a profit of $83.21 for the two-year-old hens, or 23.3 percent on the average investment; and $58.54 for the pullets, or 7.8 percent on the average investment.

CORN ROOT ROT

While the corn root rot test has not been conducted long enough to draw definite conclusions, the Department of Botany recommends that attention be given to the selection and care of the seed and that all three elements of plant food be applied.

PASTURE WORK

Tests show clearly that for rapid improvement of permanent pastures it is best to plow and fertilize the land, prepare a good seedbed and sow seed. Fertilizing the land without seeding it does not make much improvement. Applying manure seems to thicken up the sward. Clipping in June and August benefits pastures by keeping down weeds and sprouts.

SHEEP

About a dozen Shropshire ewes are kept to consume the surplus pasture and feeds. That a small flock of sheep can be kept at a profit may be seen in the following:

FINANCIAL SUMMARY OF SHEEP WORK
March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Equipment	$ 8 00	Equipment	$ 7.60
Stock	85 00	Stock	121 00
Products	19 23	Products	31 23
Expenses:		Receipts:	
Feed consumed	71 53	Sheep sold	10 25
Man-hours	31 32	Lambs sold	68 01
Horse-hours	72	Wool sold	19 23
Ram service	3 50	Pelts sold	.50
Marketing sheep	10 62	Manure	8.66
Barn rent	4 00		
To balance (profit)	32 56		
Totals	$266 48		$266.48

Note:—Man-labor 29c per hour; horse-labor 18c; feeds at market prices. The sheep were charged for pasture but no credit given for manure while on pasture. This left, $32 56, for interest on investment, overhead charges, and profit.

SOYBEANS

In a forage test of varieties of soybeans in 1921, the heaviest yields were in the order named: Biloxi, Peking, Virginia-D. C., Virginia-W. Va., Hahto, Haberlandt, Medium Green, Manchu.

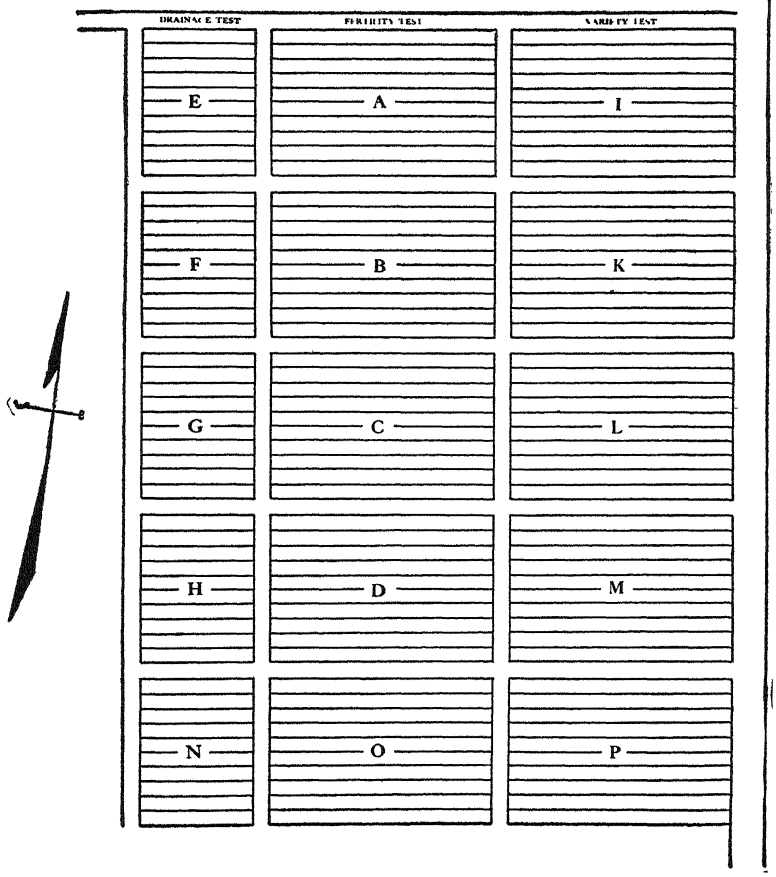
Soybean hay with corn stover, and whole soybeans with shelled corn have been fed to sheep. Medium Green soybeans have been used in the field work. Later varieties do not mature in time for wheat to follow. An effort will be made to reduce the cost of growing this crop.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS
C. E. THORNE

Four experiments with fertilizers, lime, and manure on crops grown in rotation are in progress on this farm—namely:

Rotation I: Corn, soybeans, wheat, clover, on drained and undrained land.
Rotation II: Potatoes, wheat, clover.
Rotation III: Corn, soybeans, wheat.
Rotation IV: Alfalfa, corn, wheat.



Arrangement of plots, Clermont County Experiment Farm

Blocks A, B, C, D. Fertility tests on drained land
Blocks E, F, G, H. Fertility tests on undrained land
Blocks I, K, L, M. Variety tests (drained land)
Blocks N, O, P, additional tests
The plots in each block are numbered from 1 to 10, beginning at the north side

The plan of fertilizing in these rotations is given in Table 7, The treatment of Rotation I is the same on the drained and undrained land, except for the drainage. The arrangement of plots in these rotations is shown in the diagram. The results for 1920 and 1921, and the average outcome for the entire period of the experiments are given in Tables 8 to 17.

TABLE 7.—Plan of fertilizing, Clermont County Experiment Farm

Pounds of fertilizing materials per acre for each crop

Plot No.	Acid phosphate	Muriate potash	Nitrate soda	Powdered limestone	Acid phosphate	Muriate potash	Nitrate soda	Acid phosphate	Muriate potash	Nitrate soda
	Rotation I: Corn-soybeans-wheat-clover									
	On corn				On soybeans			On wheat		
1										
2	200				100			200		
3	200	50			100	20		200	20	
4										
5	200	50	50		100	20	30	200	20	80
6	200	50	50	2 tons	100	20	30	200	20	80
7										
8	Manure, 8 tons, phosphated							200	50	50
9	Manure, 8 tons, phosphated			2 tons				200	50	50
10										
	Rotation II: Potatoes-wheat-clover									
	On potatoes				On wheat					
1										
2	200				200					
3	200	50			200	50				
4										
5	200	50	50		200	50	50			
6	400	100	100		400	100	100			
7										
8	Untreated manure, 8 tons				Untreated manure, 8 T.					
9	Untreated manure, 8 tons; Acid phosphate, 200 lb.				Untreated manure, 8 T.; Acid phosphate, 200 lb.					
10										
	Rotation III: Corn-soybeans-wheat									
1										
2	320			2 tons	200					
3	*			2 tons						
4										
5	320	50		2 tons	200	50				
6	*	100		2 tons						
7										

*Raw phosphate rock, 1,040 pounds.

COMPUTING THE EFFECT OF THE FERTILIZING MATERIALS

No acre of land is absolutely uniform in composition and moisture throughout its entire area; for this reason all the fertility experiments of the Ohio Station are conducted on long, narrow plots. Every third plot is left continuously untreated as a check, and the effect of the treatment is calculated on the assumption that variations in the soil are more likely to be gradual than abrupt. That is, that if the unfertilized yields of Plots 1 and 4 were 10 and 13 bushels, respectively, the yields of Plots 2 and 3, had they been left unfertilized, probably would have been 11 and 12 bushels. All the tables in this report have been calculated in this way. The average yields of the unfertilized plots are given at the bottom of each table, but these averages are not employed in computing the increases from the separate treatments. When, however, it becomes desirable to compare the total yields of the different plots, this is done by adding the computed increases to the average unfertilized yields. In this manner Table 13 has been computed, in order to bring out more clearly the separate effect of the different fertilizers, manure, and limestone on the drained and undrained land.

FERTILIZERS AND MANURE ON DRAINED AND UNDRAINED LAND

Table 13 shows that in every case the unfertilized yields have been larger on the undrained than on the drained land, showing that the undrained land has been superior in natural fertility, but the effect of the fertilizing materials has generally been greater on the drained land.

Effect of manure.—The calculation of the separate effect of manure is complicated by the fact that manure has been used in combination with different quantities of fertilizing materials from those used on Plots 2 to 6.

Acid phosphate has been used at the rate of 500 pounds per acre for each 4-year period on these plots, and the increase found on Plot 2 amounts to $2.32 on the drained land and $2,29 on the undrained land for 100 pounds of acid phosphate.

Muriate of potash has been used at the rate of 90 pounds per acre for each rotation and the increase on Plot 3 gives a return of $8.91 for 100 pounds on the drained land and $7.24 on the undrained land over that found on Plot 2.

Nitrate of soda has been used at the rate of 160 pounds per acre for each rotation and the increase on Plot 5 gives $6.56 for 100 pounds of nitrate on the drained land and $2.46 on the undrained, over the yields of Plot 3.

Applying these valuations to the 520 pounds of acid phosphate and 50 pounds each of muriate of potash and nitrate of soda that have been used in connection with the manure on Plots 8 and 9, we have a total value which should be credited to the chemicals of $19.79 on the drained land and $16.75 on the undrained land. This leaves $28.27 on the drained land and $12.32 on the undrained land as the proportionate share of the 8 tons of manure, if no reduction is made for interest on cost of drainage nor for additional cost of harvesting. This would give a productive valuation per ton of manure of $3.53 on the drained land and $1.54 on the undrained land.

In considering this financial outcome it should be remembered that the cost of fertilizers, as computed for Plots 5, 6, 8, and 9, is based upon their cost in acid phosphate, muriate of potash, and nitrate of soda. If purchased ready mixed the cost would be 25 to 50 percent greater and the effectiveness would probably be less.

In computing the financial outcome of these experiments, as given in Tables 13 and 16, corn and potatoes are rated at half a dollar a bushel, soybeans at a dollar and a quarter, wheat at a dollar, hay at ten dollars a ton, corn stover and soybean straw at four dollars a ton and wheat straw at two dollars.

It costs no more per acre to plant, cultivate, and cut a large yield than a small one, except possibly a small additional cost for cutting heavy corn; but it does cost more to get the larger yield from the field to the market, although this cost is not proportionate to the quantity of yield, because of the smaller area to be traveled over in gathering it. Moreover, the effect of fertilizing, and especially of manuring and liming, extends far beyond the period of application. In the Rothamsted experiments, for example, where manure had been applied for 7 years and then discontinued for 20 years, the yield at the end of that period was still twice as great as that on the unmanured land alongside.

It will not be questioned that a farm which has yielded more than 50 bushels of corn and 20 bushels of wheat as an average for a term of years will rent for more money than one which has given only two-thirds those yields. These experiments show that the judicious use of fertilizers, lime, and manure will immediately increase the earning capacity of this Clermont soil, an increase which will certainly be manifested for several years after all treatment has been discontinued. They show further that underdrainage is a permanent addition to the potential earning capacity of this land, provided it be followed by a rational system of agriculture,

and, therefore, should be considered in the same light as are substantial buildings and similar improvements.

In computing the financial outcome of this experiment, as given in Table 12, no deduction has been made for cost of drainage or cost of harvesting the additional yields produced by the treatment. The original cost of the drainage, the drains being laid 30 inches deep and 50½ feet apart, was $33.81 per acre. The interest on this investment at 6 percent is $2.03 per annum.

If $2.00 an acre were added to the annual cost of treatment for the drained land to cover interest on cost of drainage, and the value of the increase on both drained and undrained land were reduced by 25 percent to offset the extra cost of harvesting, the net value of the annual increase per acre would be as follows:

Plot no.	Drained	Undrained
2	$—0.80	$1.00
3	0.18	1.85
5	1.12	1.39
6	1 41	1.60
8	2.96	1.40
9	3.31	1.17

Bearing in mind that in this computation the interest on the cost of the drainage and all extra labor cost due to the larger yields obtained have been deducted, there still remains an annual balance on Plot 9 of more than $2.00 an acre in favor of the drained land, or 6 percent on $33.00. Adding this amount to the cost of drainage, which is also covered by the larger production, we have a total increased productive value of more than $60.00 an acre for the drained land in excess of the value of the same land before drainage.

THE VALUATION OF MANURE

It appears that the increase from drainage has not been sufficient to pay the interest on its cost, at the low prices for produce here employed, except on the manured land, and it would not have paid the interest on this land had manure been valued on the basis of the cost of its constituents in chemical fertilizers.

Analyses made by Ames and his co-workers at the Ohio Experiment Station, show that horse and cattle manure when fresh should carry the following constituents in pounds per ton:

	Nitrogen	Phosphoric acid	Potash
Horse manure	14	5	15
Cattle manure	12	6	11

After exposure for three months in an open barnyard, however, the constituents of cattle manure have been reduced to less than 7 pounds of nitrogen, 5 pounds of phosphoric acid, and 4 pounds of potash per ton.

The manure used in the Clermont experiments has been mixed horse and cattle manure, partially protected from the weather; its average composition is estimated at about 8 pounds each of nitrogen and potash and 5 pounds of phosphoric acid per ton. On this estimate the dressings given to Plots 5 and 6 on the one hand and to Plots 8 and 9 on the other would contain the following constituents for each 4-year period, in addition to the liming, in pounds per acre:

	Nitrogen	Phosphoric acid	Potash
Plots 5 and 6	24	80	45
Plots 8 and 9	72	123	89

One hundred pounds of nitrate of soda should contain 15½ pounds of nitrogen. If nitrate of soda can be purchased at 3 cents a pound the pound of nitrogen will cost nearly 20 cents. Muriate of potash should be half actual potash, hence if the muriate be purchased at 3 cents a pound the cost of a pound of potash will be 6 cents. If 16 percent acid phosphate be purchased at $19.20 per ton the cost of a pound of phosphoric acid will be 6 cents. At these valuations the constituents carried in a ton of manure, at the composition estimated above, will have a comparative value of about $2.40, and the annual cost of the dressing would be $6.80 on Plot 8 and $8.80 on Plot 9, or of $8.80 and $10.80, respectively, when interest on cost of drainage is added. These costs, applied to Table 12, would leave smaller balances from the manure than from the chemicals. If, however, the constituents of manure be computed at their cost in factory-mixed fertilizer it would be necessary to compute the cost of the chemicals at about 50 percent higher rates than those given in the table, thus turning the scale again in favor of manure.

On the other hand, the cost of moving manure to the field on the average farm should be considerably less than $1.00 a ton, so that if no charge is made against the manure except this cost the balances from its use should be larger than those given in the table.

If, therefore, the livestock operations of the farm are so managed that the market value of the feed consumed is realized, leaving the manure with no charge against it but that of getting it onto the field, it will become, next to clover, the cheapest of fertilizing materials for drained land.

THE POTATOES-WHEAT-CLOVER ROTATION

The yields of potatoes in this test have been so unsatisfactory that the question is being seriously considered whether the attempt to grow spring-planted potatoes shall not be abandoned and the planting be delayed until mid-summer.

The chief objection to this change is that it will make the harvesting of the potatoes so late that it will be necessary to substitute some other crop for wheat in the rotation. The remarkable effect of potatoes upon the wheat crop following leaves room to doubt whether anything would be gained in the end.

Tables 14 and 15 show the yields thus far realized in this rotation, and Table 16 gives the financial outcome, and also, for comparison, the financial outcome in the corn-soybeans-wheat-clover rotation on the same farm. In this table the cost of seed per acre is computed at 20 cents for corn, $1.00 for soybeans, $2.00 for wheat, $1.80 for clover seed, and $11.20 for potatoes. Of course, these costs will vary on different farms and in different seasons; but computed on this basis the annual balances in the potato rotation exceed those in the cereal rotation by $2.00 to $5.00 an acre for every treatment excepting those in which purchased nitrogen is employed, the nitrate of soda having added nothing to the yield, while materially increasing the cost, in the potato rotation.

This outcome is in harmony with the parallel experiment on the Hamilton County Experiment Farm, and with the 25-year results in the similar rotation at Wooster, where the net increase, after deducting cost of fertilizers, has been $4.77 annually for acid phosphate and muriate of potash, and $3.09 for the same quantities of these materials with nitrate of soda added.

Apparently the potato is either able to obtain nitrogen from sources unavailable to the cereals, or else it leaves the land in such condition that succeeding crops find an extra supply of nitrogen made available for their use.

PRACTICAL APPLICATIONS

The National Census shows that in 1919 there were 3,803 farms in Clermont County, with an average area of 72.6 acres per farm, of which 60.6 acres were classed as improved. Nearly 600 of these farms, however, contained less than 20 acres each, and were probably devoted chiefly to trucking. Excluding these, the size of the average farm was about 90 acres. Probably the larger number of the farms of the county contain 90 to 100 acres.

The census and State statistics indicate that for a farm of 100 acres the distribution of land would be approximately as follows:

	Acres
Woodland	10
Orchards, building lots, roads, fencerows	12
Corn	20
Wheat and rye	12
Oats	3
Hay crops (chiefly timothy)	13
Pasture	30
	100

These figures would indicate that where any systematic crop rotation is followed it is likely to consist of 2 years in corn, followed by 1 year each in wheat and hay, and 2 or 3 years in pasture.

The average crop yields for the 10 years, 1910-1919, as reported by the township assessors, were 29.8 bushels of corn, 19.6 bushels of oats, 13.3 bushels of wheat and a little less than a ton of hay per acre.

If, for comparative purposes, we value these crops at the prices stated on page 392, their approximate area and value would be as shown in Table 17, the yields of stover and straw being computed on the basis of 50 pounds of stover or oat straw and 100 pounds of wheat straw to the bushel of grain. Rye is computed as wheat.

The Census statistics show that for every hundred acres there were found in Clermont County 3.6 horses, 4.8 cows, 3 steers and young cattle, 1 or 2 sheep and about 4 hogs. Part of the horses were young and the figures indicate from 3 to 4 working horses and 4 or 5 cows on each farm.

Computing 10 hogs or sheep as equivalent to one horse or cow for manure production, there would be the equivalent of about 9 head of cattle on the average farm of this size, or a total of 25,000 head for the county. In 1918 the township assessors reported the collection and use in the county of 100,000 loads of manure, presumably about a ton to the load, which would indicate a collection of about 36 tons for each 100-acre farm.

The National census shows that a total of $90,000 was expended in this county for commercial fertilizers during the census year. The assessors' reports indicate that the larger proportion of the fertilizers used in the county is bought ready mixed, and considering the high prices prevalent during the Census year it is probable that the annual purchase of such fertilizers amounts to about one ton for the average 100-acre farm. These calculations would indicate a sufficient supply of manure and fertilizers to provide about 3 tons of manure and 120 pounds of fertilizer per acre for 2 crops of corn and 1 crop of wheat, leaving none for the hay crops or pastures.

If the 48 acres in grain and hay on the 100-acre Clermont farm were equally divided between corn, soybeans, wheat, and clover, as is done on the county experiment farm, and the treatment given and outcome realized on Plot 8 on that farm were to be repeated on these 12-acre fields, the outcome should be as shown in Table 18.

The three grain crops in this rotation have received a total of 8 tons of manure per acre, or 2⅔ tons per crop, together with a total of 620 pounds of fertilizer—320 pounds of acid phosphate mixed with the 8 tons of manure, which is all given to the corn crop, and 200 pounds of acid phosphate and 50 pounds each of muriate of potash and nitrate of soda given to the wheat—instead of the 3 tons of manure and 120 pounds of fertilizer which it is estimated that three average acres of grain crops have received over the county. This would involve the annual accumulation of nearly three times as much manure as is now saved, together with the purchase for each 100-acre farm of nearly 4 tons of fertilizer instead of 1 ton.

The manure problem is more difficult to solve. There is no doubt that a very considerable percentage of the manure now produced is lost through exposure in open barnyards before it goes to the field, and that on many farms the stock might be stabled earlier in the fall and turned out later in the spring with very material advantage to the pastures. One of the serious disadvantages in the system of farming in which pasturing succeeds two or three years of grain production is the poaching of the land by permitting cattle or horses to roam over it when soft from recent rains or from frost coming out in the spring. There can be no doubt that this is one of the causes of the low yields found in the southern hill counties of Ohio. Many of the most successful farmers, all over Ohio, have discontinued the pasturing of the grain fields, removing all fences except those required to enclose permanent pastures, thus reducing the cost of fence up-keep and at the same time improving the texture and consequent productiveness of the land.

The present livestock of the average Clermont County farm would easily furnish half the manure necessary to carry out the scheme of manuring and fertilizing in contemplation were these three points put into effect—namely:

1. Stabling the stock a week or two earlier in the fall and turning out a week or two later in the spring.
2. Protecting the manure from exposure to the weather until it can be spread on the field—and there is no better time to spread it than the day it is dropped, when that is practicable, as shown by the experiment on these points that has been running 25 years at the Wooster Station.
3. Limiting the pastures to land used for that purpose only.

If to this last point the policy be added of treating the pastures to a dose of limestone about once in 10 years and to one of acid phosphate about every second year, a sod of bluegrass and white clover will take the place of the many pastures now foul with broom-sedge, cinquefoil, ox-eye-daisy, wild carrot, and yarrow, the injury from trampling will be reduced, and the present carrying capacity of the land will be doubled.

These measures will materially increase the production of even undrained land, and this increased production will in turn make possible the keeping of more livestock and the production of more manure.

But the work on the Experiment Farm lends no encouragement to the expectation that the maximum profit in crop production can be attained on the flat, soggy land which covers a large part of the high table land of Clermont County, until the land is drained; this work, however, has shown that the increased effect of treatment following drainage will amply justify borrowing the money required.

It would seem prudent to limit the drainage, at first at least, to the land required for grain production, and this is another reason for a permanent separation of the pasture land from the grain land.

White clover and bluegrass, if given proper encouragement, will work wonders on land that is still a little too soggy for the highest yields in grain production.

The present average yields in Clermont County are affording but a bare subsistence to the farmer. The work of the Experiment Farm points the way to improvement, both by showing where more money can be loaned to the land with assurance of a profitable return, and by pointing out sources of loss that should be avoided.

There has never been a time when money could be borrowed for judicious expenditures on the farm on such favorable terms as today, and there has never been a time when the lines for such expenditure were so clearly marked as now.

TABLE 8.—Fertilizers, manure, and limestone on CORN, Clermont County Experiment Farm. Drained and undrained land
Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot No.
Rotation I: Corn-soybeans-wheat-clover. Drained land		Block D				Block A				8-year average				
1	None	15.57	1,550			38.56	1,650			22.80	1,500			1
2	Acid phosphate, 200 lb	19.14	1,900	1.52	383	35.00	1,650	—2.90	—17	27.05	1,669	4.48	172	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	30.00	2,350	10.34	867	50.57	1,900	13.34	217	35.77	1,969	13.43	475	3
4	None	21.71	1,450			36.57	1,700			22.11	1,491			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	36.14	2,650	15.05	1,100	60.71	1,950	26.85	283	41.19	2,021	19.00	533	5
6	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb. ground limestone, 2 tons	48.29	2,600	27.81	950	59.14	2,110	28.00	477	43.98	2,101	21.70	617	6
7	None	19.86	1,750			28.43	1,600			22.37	1,481			7
8	Phosphated manure, 8 tons	58.71	2,950	36.66	1,100	66.00	2,200	41.14	783	52.43	2,379	31.69	937	8
9	Phosphated manure, 8 tons; ground limestone, 2 tons	67.57	3,100	43.33	1,150	55.14	1,800	33.86	567	52.75	2,627	33.66	1,225	9
10	None	26.43	2,050			17.71	1,050			17.45	1,362			10
	Average unfertilized yield	20.89	1,700			30.32	1,500			21.18	1,459			
	Average fertilized yield	43.31	2,592			54.43	1,935			42.20	2,128			
Rotation I: Corn-soybeans-wheat-clover. Undrained land		Block H				Block E				8-year average				
1	None	12.00	1,100			21.43	1,200			20.66	1,281			1
2	Acid phosphate, 200 lb	17.43	1,900	5.81	533	27.14	1,000	2.66	—233	23.59	1,319	1.77	—52	2
3	Acid phosphate, 200 lb.: muriate potash, 50 lb	10.29	2,500	—.95	867	56.00	2,000	28.48	733	31.66	1,837	8.68	377	3
4	None	10.86	1,900			30.57	1,300			24.14	1,550			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	8.86	2,000	—1.33	233	62.57	2,100	29.81	733	33.75	1,769	9.48	231	5
6	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.; ground limestone, 2 tons	18.29	1,600	8.76	—33	66.86	2,400	31.91	967	38.88	1,712	14.47	187	6
7	None	8.86	1,500			37.14	1,500			24.54	1,514			7
8	Phosphated manure, 8 tons	10.29	1,700	3.24	400	58.00	1,900	19.72	400	36.13	1,705	12.61	312	8
9	Phosphated manure, 8 tons; ground limestone, 2 tons	14.86	1,600	9.62	500	61.14	1,800	21.71	300	36.70	1,706	14.21	435	9
10	None	3.43	900			40.57	1,500			21.46	1,150			10
	Average unfertilized yield	8.79	1,350			32.43	1,375			22.70	1,374			
	Average fertilized yield	13.34	1,883			55.28	1,867			33.45	1,675			

TABLE 9.—Fertilizers and manure on SOYBEANS, Clermont County Experiment Farm. Drained and undrained land Yield and increase per acre

Plot	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot
Rotation I: Corn-soybeans-wheat-clover. Drained land		Block C				Block D				7-year average				
1	None	8.50	690			7.67	840			7.95	1,163			1
2	Acid phosphate, 100 lb	15.50	1,520	6.44	747	12.50	1,050	4.39	220	10.76	1,533	2.51	351	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	14.67	1,570	5.06	713	15.33	1,130	6.77	310	12.09	1,646	3.54	444	3
4	None	10.17	940			9.00	810			8.86	1,221			4
5	Acid phos., 100 lb.; mur. pot., 20 lb.; nitrate soda, 30 lb	15.17	1,440	5.11	510	14.67	1,270	5.90	480	12.76	1,824	4.06	621	5
6	Acid phos., 100 lb.; mur. pot., 20 lb.; nitrate soda, 30 lb.*	16.83	1,590	6.89	670	17.00	1,230	8.44	460	14.17	1,899	5.63	714	6
7	None	9.83	910			8.33	750			8.38	1,166			7
8	Phosphated manure on corn	21.83	1,590	11.89	753	18.33	1,300	8.94	513	14 43	1,903	6.05	753	8
9	Phosphated manure and ground limestone on corn	21.67	1,850	11.61	1,087	20.33	1,280	9.89	457	15.67	2,127	7.29	993	9
10	None	10.17	690			11.50	860			8.38	1,119			10
	Average unfertilized yield	9.67	807			9.12	815			8.39	1,167			
	Average fertilized yield	21.61	1,593			16.36	1,210			13.31	1,822			
Rotation I: Corn-soybeans-wheat-clover: Undrained land		Block G				Block H				7-year average				
1	None	10.67	1,060			21.00	2,040			11.28	1,880			1
2	Acid phosphate, 100 lb	16.67	900	6.33	—13	22.00	1,480	2.78	—133	12.57	1,889	1.21	80	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	18.00	1,220	8.00	453	20.67	1,560	3.22	373	13.86	1,997	2.41	260	3
4	None	9.67	620			15.67	760			11.53	1,666			4
5	Acid phos., 100 lb.; mur. pot., 20 lb.; nitrate soda, 30 lb.	10.00	1,100	—1.45	187	20.33	1,580	5.89	880	14.10	2,083	2.43	462	5
6	Acid phos., 100 lb.; mur. pot., 20 lb.; nitrate soda, 30 lb.*	26.33	1,520	13.11	313	18.00	1,820	4.77	1,120	17.19	2,363	5.38	778	6
7	None	15.00	1,500			12.00	580			11.95	1,531			7
8	Phosphated manure on corn	20.67	1,960	4.23	413	22.67	1,920	10.77	1,167	16.29	2,420	4.41	824	8
9	Phosphated manure and ground limestone on corn	22.33	1,860	4 44	267	21.67	1,620	9.90	693	17.86	2,646	6.06	985	9
10	None	19.33	1,640			11.67	1,100			11.71	1,726			10
	Average unfertilized yield	13.67	1,205			15.08	1,120			11.62	1,701			
	Average fertilized yield	19.00	1,427			20.89	1,663			15.31	2,233			

*Ground limestone on corn.

TABLE 10.—Fertilizers and manure on WHEAT, Clermont County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
Rotation I: Corn-soybeans-wheat-clover. Drained land		Block B				Block C				7-year average				
1	None	2.50	250			7.50	650			8.12	820			1
2	Acid phosphate, 200 lb	8.50	740	6.33	503	16.17	1,580	8.50	790	12.62	1,250	4.84	414	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	7.00	930	5.17	707	17.83	1,630	10.00	700	13.29	1,267	5.85	416	3
4	None	1.50	210			8.00	1,070			7.10	867			4
5	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 80 lb.	12.17	820	10.11	627	20.83	2,050	12.33	993	18.33	1,714	11.07	874	5
6	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 80 lb.*	19.83	1,510	17.22	1,333	25.50	2,870	16.50	1,827	21.98	2,011	14.55	1,198	6
7	None	3.17	160			9.50	1,030			7.60	787			7
8	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	17.50	1,300	13.89	1,117	25.33	2,780	16.33	1,837	20.19	1,899	13.10	1,200	8
9	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.*	23.67	1,430	19.61	1,223	26.67	3,200	18.17	2,343	24.48	2,331	17.90	1,721	9
10	None	4.50	230			8.00	770			6.07	521			10
	Average unfertilized yield	2.92	212			8.25	880			7.22	749			
	Average fertilized yield	14.78	1,122			22.05	2,352			18.48	1,746			
Rotation I: Corn-soybeans-wheat-clover. Undrained land		Block F				Block G				7-year average				
1	None	8.00	1,120			6.33	620			5.76	640			1
2	Acid phosphate, 200 lb	14.67	1,220	7.23	333	14.00	1,160	7.78	467	14.29	1,209	8.01	502	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	15.67	1,560	8.78	907	14.67	1,420	8.56	653	16.05	1,643	9.27	870	3
4	None	6.33	420			6.00	840			7.29	840			4
5	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 50 lb.	17.33	1,160	10.33	747	17.67	1,940	11.56	1,040	18.81	1,609	11.40	750	5
6	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 50 lb.*	24.33	1,940	16.67	1,533	21.67	1,900	15.45	940	22.14	2,114	14.60	1,236	6
7	None	8.33	400			6.33	1,020			7.67	897			7
8	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.	21.00	2,140	13.89	1,833	18.67	2,280	12.89	1,427	18.81	2,043	10.57	1,078	8
9	Acid phos., 200 lb.; mur. pot., 50 lb.; nitrate soda, 50 lb.*	26.67	2,000	20.78	1,787	19.33	2,540	14.11	1,853	21.43	2,274	12.62	1,242	9
10	None	4.67	120			4.67	520			9.38	1,100			10
	Average unfertilized yield	6.83	515			5.83	750			7.52	869			
	Average fertilized yield	19.94	1,670			17.67	1,873			18.59	1,816			

*Ground limestone on corn.

TABLE 11.—Residual effect on CLOVER of treatment of previous crops in corn-soybeans-wheat-clover rotation
Clermont County Experiment Farm

Plot	Total fertilizers, manure and limestone per acre on previous crops of rotation	Drained land						Undrained land						Plot
		1920		1921		Average		1920		1921		Average		
		Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	
	Rotation I: Corn-soybeans-wheat-clover	Block A		Block B		6-year average		Block E		Block F		6-year average		
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	
1	None	2,105		716		1,207		1,011		1,684		1,376		1
2	Acid phosphate, 500 lb	1,389	—506	1,221	547	1,410	280	1,684	280	1,684	—84	1,712	214	2
3	Acid phosphate, 500 lb.; muriate potash, 90 lb	2,063	379	1,600	969	1,586	533	1,516	—280	2,611	758	1,895	276	3
4	None	1,474		589		975		2,189		1,937		1,740		4
5	Acid phos. 500 lb.; muriate potash, 90 lb.; nitrate soda, 160 lb	2,779	1,263	1,937	1,236	1,951	903	2,021	84	3,200	1,095	2,302	552	5
6	Acid phos., 500 lb.; mur. potash, 90 lb.; nitrate soda, 160 lb.; ground limestone, 2 tons	4,421	2,863	3,074	2,260	2,968	1,848	2,526	842	3,705	1,431	2,596	837	6
7	None	1,600		926		1,193		1,432		2,442		1,768		7
8	Phosphated manure, 8 tons; acid phosphate, 200 lb.; muriate potash, 50 lb.; nitrate soda, 50 lb	3,074	1,614	2,863	1,979	2,505	1,394	2,105	477	3,621	1,179	2,470	669	8
9	Phos. manure, 8 tons; acid phos. 200 lb.; mur. potash, 50 lb.; nit. soda. 50 lb.; ground limestone, 2 tons	4,084	2,765	3,200	2,358	3,144	2,115	2,021	196	4,547	2,105	3,256	1,422	9
10	None	1,179		800		947		2,021		2,442		1,867		10
	Average unfertilized yield	1,589		758		1,080		1,663		2,126		1,688		
	Average fertilized yield	2,968		2,316		2,261		2,979		3,228		2,372		

TABLE 12.—Corn-soybeans-wheat-clover rotation: Clermont County Experiment Farm. Annual cost of treatment and value of increase per acre on drained and undrained land

Plot No.	Total fertilizer, manure and limestone per each 4-year period	Annual cost of treatment*	Drained land		Undrained land	
			Value of increase	Balance	Value of increase	Balance
2	Acid phosphate, 500 lb	$1.25	$3.27	$2.02	$3.01	$1.76
3	Acid phosphate, 500 lb.; muriate potash, 90 lb	1.93	5.48	3.55	5.03	3.10
5	Acid phosphate, 500 lb.; muriate potash, 90 lb.; nitrate soda, 160 lb	3.13	8.33	5.20	6.03	2.90
6	Acid phosphate, 500 lb.; muriate potash, 90 lb.; nit. soda, 160 lb.; ground limestone, 2 tons	5.13	11.38	6.75	8.97	3.84
8	Phosphated manure,† 8 tons; acid phosphate, 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb	4.05	12.01	7.96	7.27	3.22
9	Phosphated manure,† 8 tons; acid phosphate, 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.; ground limestone, 2 tons	6.05	15.14	9.09	9.62	3.57

*Computing acid phosphate at 1 cent a pound, and nitrate of soda and muriate of potash each at 3 cents.
†40 pounds acid phosphate per ton of manure.

TABLE 13.—Relative increase per acre from different fertilizing materials Clermont County Experiment Farm

Plot	Treatment		Yield and increase per acre				Value of increase*
			Corn	Soybeans	Wheat	Clover	
No.			*Bu.*	*Bu.*	*Bu.*	*Lb.*	
	Unfertilized	Drained	21.18	8.39	7.22	1,080	.....
		Undrained	22.70	11.62	7.52	1,688	.....
2	Acid phosphate	Drained	25.66	10.90	12.06	1,360	.....
		Undrained	24.47	12.83	15.53	1,902	.....
	Increase for acid phosphate	Drained	4.48	2.51	4.84	280	$11.62
		Undrained	1.77	1.21	8.01	214	11.47
3	Acid phosphate, muriate potash	Drained	34.61	11.93	13.07	1,613	.....
		Undrained	31.38	14.03	16.79	1,964	.....
	Increase for muriate potash	Drained	8.95	1.03	1.01	253	8.02
		Undrained	6.91	1.20	1.26	62	6.52
5	Acid phosphate, muriate potash, nitrate soda	Drained	40.18	12.45	18.29	1,983	.....
		Undrained	32.18	14.05	18.92	2,240	.....
	Increase for nitrate soda	Drained	5.57	.52	5.22	370	10.50
		Undrained	.80	.02	2.13	276	3.93
6	Acid phosphate, muriate potash, nitrate soda, limestone	Drained	42.88	14.02	21.77	2,928	.....
		Undrained	37.17	17.00	22.12	2,525	.....
	Increase for limestone	Drained	2.70	1.57	3.48	945	11.51
		Undrained	4.99	2.95	3.20	285	10.81

*Omitting values of stover and straw.

TABLE 14.—Fertilizers and manure on POTATOES and WHEAT in potatoes-wheat-clover rotation, Clermont County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre	1920				1921				Average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Potatoes or wheat Bu.	Straw Lb.	Potatoes or wheat Bu.	Straw Lb.	Potatoes or wheat Bu.	Straw Lb.	Potatoes or wheat Bu.	Straw Lb.	Potatoes or wheat Bu.	Straw Lb.	Potatoes or wheat Bu.	Straw Lb.	
	Potatoes	Block P				Block Q				8-year average				
1	None	11.67				7.67				37.13				1
2	Acid phosphate, 200 lb	14.00		3.89		8.67		2.22		46.92		9.65		2
3	Acid phosphate, 200 lb.; muriate potash, 100 lb	25.33		16.77		9.67		4.44		51.71		14.30		3
4	None	7.00				4.00				37.54				4
5	Acid phos., 200 lb.; mur. pot., 100 lb.; nit. soda, 100 lb.	3.33		−5.11		10.00		5.89		44.96		7.48		5
6	Acid phos., 400 lb.; mur. pot., 200 lb.; nit. soda, 200 lb.	20.33		10.44		19.00		14.78		56.17		18.76		6
7	None	11.33				4.33				37.33				7
8	Untreated manure, 8 tons	52.00		39.45		23.67		19.11		70.83		33.90		8
9	Untreated manure, 8 tons; acid phosphate, 200 lb.	57.67		43.89		37.00		32.22		77.96		41.43		9
10	None	15.00				5.00				36.12				10
	Average unfertilized yield	11.25				5.25				37.03				
	Average fertilized yield	28.78				18.00				58.09				
	Wheat	Block R				Block P				7-year average				
1	None	7.33	360			12.00	1,320			14.48	1,300			1
2	Acid phosphate, 200 lb	21.33	1,720	12.67	1,207	22.33	3,320	9.89	1,675	26.05	2,489	11.24	1,058	2
3	Acid phosphate, 200 lb.; muriate potash, 100 lb	25.33	2,080	15.33	1,413	28.33	3,500	15.44	1,527	30.52	3,269	15.38	1,708	3
4	None	11.33	820			13.33	2,300			15.47	1,691			4
5	Acid phos., 200 lb.; mur. pot., 100 lb.; nit. soda, 100 lb.	23.00	2,120	11.00	1,140	24.00	2,560	10.78	220	27.38	2,946	11.16	1,187	5
6	Acid phos., 400 lb.; mur. pot., 200 lb.; nit. soda, 200 lb.	23.00	1,520	10.34	380	28.00	3,520	14.89	1,140	28.52	3,009	11.55	1,182	6
7	None	13.33	1,300			13.00	2,420			17.71	1,894			7
8	Manured on potatoes	28.33	2,700	15.55	1,433	28.00	3,620	15.22	1,453	29.90	3,491	13.08	1,718	8
9	Manured on potatoes	31.67	3,000	19.45	1,767	25.67	4,560	13.12	2,647	30.29	3,863	14.35	2,211	9
10	None	11.67	1,200			12.33	1,660			15.05	1,531			10
	Average unfertilized yield	10.91	920			12.67	1,925			15.67	1,604			
	Average fertilized yield	25.44	2,190			26.06	3,513			28.78	3,177			

TABLE 15.—Residual effect on CLOVER of treatment of previous crops in Potatoes-wheat-clover rotation
Clermont County Experiment Farm

Plot	Total treatment on previous crops of rotation	Yield and increase per acre						Plot
		1920, Block Q		1921, Block R		6-year average		
		Yield	Increase	Yield	Increase	Yield	Increase	
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	
1	None	1,179	.....	2,611	.....	1,763	.....	1
2	Acid phosphate, 400 lb	3,200	2,302	2,695	140	2,721	951	2
3	Acid phosphate, 400 lb.; muriate potash, 200 lb	1,516	898	2,968	470	2,890	1,113	3
4	None	337	.....	2,442	.....	1,784	.....	4
5	Acid phosphate, 400 lb.; muriate potash, 200 lb.; nitrate soda, 200 lb	1,684	1,319	2,526	56	2,636	823	5
6	Acid phosphate, 800 lb.; muriate potash, 400 lb.; nitrate soda, 400 lb	3,368	2,975	3,200	702	3,158	1,315	6
7	None	421	.....	2,526	.....	1,873	.....	7
8	Untreated manure, 16 tons	4,715	4,322	4,095	1,513	4,505	2,701	8
9	Untreated manure, 16 tons; acid phosphate, 400 lb	4,970	4,605	4,042	1,403	4,350	2,616	9
10	None	337	.....	2,695	.....	1,665	.....	10
	Average unfertilized yield	568	.....	2,568	.....	1,772	.....	
	Average fertilized yield	3,242	.....	3,254	.....	3,377	.....	

TABLE 16.—Comparative financial outcome in Potatoes-wheat-clover rotation and Corn-soybeans-wheat-clover rotation. Clermont County Experiment Farm

Plot No.	2	3	5	6	8	9	*
Potatoes-wheat-clover rotation							
Potatoes, value per acre	$23.33	$25 66	$22.25	$27.89	$35.46	$39.23	$18.51
Wheat, value per acre	29.57	34.36	29.62	30.00	32.07	33.83	17.27
Clover, value per acre	13.61	14.42	12.97	15.43	22.36	21.94	8.86
Total value for rotation	66.51	74.44	64.84	73.32	89.89	95.00	44.64
Cost of seed and fertilizer	19.00	25.00	31.00	47.00	31.00	35.00	15.00
Balance (for rental and labor)	47.51	49.44	33.84	26.32	58.89	60.00	29.64
Annual balance	15.84	16.48	11.28	8.87	19.63	20.00	9.88
Corn-soybeans-wheat-clover rotation							
Corn, value per acre	$16.08	$21.16	$24.06	$25.58	$31.21	$32.78	$13.50
Soybeans, value per acre	16.66	18.13	19.13	21.29	21.88	23.92	12.82
Wheat, value per acre	13.22	14.24	19.91	23.72	22.27	27.59	7.97
Clover, value per acre	6.80	8.06	9.91	14.64	12.37	15.97	5.40
Total value per rotation	52.76	61.59	73.01	85.23	87.73	100.26	39.69
Cost of seed and fertilizer	10.00	12.70	17.50	25.50	21.20	29.20	5.00
Balance (for rental and labor)	42.76	48.89	55.51	59.73	66.53	71.06	34.69
Annual balance	10.69	12.24	13.88	14.93	16.63	17.76	8.67

*Value of average unfertilized yield.

TABLE 17.—Area in crops and average production and value on Clermont County farm of 100 acres

Crop	Acres	Grain	Straw or hay	Value
	No.	*Bu.*	*Tons*	*Dollars*
Corn	20	596	15	358
Wheat	12	160	8	176
Oats	3	60	1½	23
Hay	13		12	120
Total	48			677

TABLE 18.—Estimated yields on possible Clermont County farm

Crop	Acres	Yield per acre	Total yield		Value
			Grain	Straw or hay	
	No.	*Bu.*	*Bu.*	*Tons*	*Dollars*
Corn	12	52	624	15½	374
Soybeans	12	14	168	7	238
Wheat	12	20	240	12	264
Hay	12	1¼ T.		15	150
Total	48				1,026

VARIETY AND CULTURAL WORK

DEPARTMENT OF AGRONOMY

CORN

The yields of corn on the Clermont County Experiment Farm have been low. As an average for the 9 years of the test, a strain of Reid's (Orcutt) grown in Madison County has yielded the highest, 29.55 bushels, per acre, Darke County Mammoth second, Leaming from Clinton County third, and Cook's 75—a strain of Reid's from Hardin County—fourth.

OATS

In the variety test of oats, Silver Mine is ahead in yield with but very little lead over Big Four. Miami and Ohio 7009 are practically a tie for third place.

WHEAT

Four varieties of wheat have been tested for 8 years, two for 7, and two for 6 years. Gladden is first in yield; Nigger, second; and Mediterranean, third.

Date of Seeding.—In Table 22 are given the yields of wheat when sown at weekly intervals from September 1 to October 30. From the 5th to the 12th of October has given better results than from the 22d to 29th of September.

Rate of Seeding.—A test of rate-of-seeding wheat for the 5-year period of 1915 to 1919 shows that 8 pecks of seed gave the largest net yield (bushels produced less seed used). For detailed report, see Ohio Experiment Station Bul. No. 344, Part III.

SOYBEANS

Six varieties of soybeans and one of cowpeas have been tested for seven years with results as given in Table 23. Midwest has the lead, Ebony second and Elton third. All varieties have been giving low yields in this county.

A test of soybean varieties for hay made in 1918 and 1919 indicated that Ebony, Medium Green, and Midwest may be expected to give from 1¼ tons to 2 tons of hay per acre. See Ohio Experiment Station Bul. No. 344, Part III.

TABLE 19.—VARIETIES OF CORN, YIELD PER ACRE

Variety	1920	1921	9-year average‡	
			Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Lb.*
Leaming	32.14	34.74	25.88	1,325
Clarage	29.28	29.74	23.64	1,317
White Cap	26.90	.....	19.62	1,312*
Cook's 75	35.24	31.56	24.40	1,470
Reid (Orcutt)	60.48	40.08	29.55	1,652
Darke Co. Mammoth	41.43	37.60	27.58	1,406
Ohio 84	29.53	22.46	19.31	1,731†

*8-year average.
†7-year average.
‡The yields of corn, oats, wheat, and soybeans for the individual years prior to 1920 are given in Bulletin No. 344, Part 3.

TABLE 20.—VARIETIES OF OATS, YIELD PER ACRE

Variety	1920	1921	8-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Big Four	30.54	28.62	29.36	1,559
Silver Mine	50.00	26.98	29.44	1,272
Swedish Select	39.06	29.48	26.10	1,407
Ohio 7009	37.82	23.54	28.30	835*
Miami (Ohio 6203)	44.14	24.08	28.34	1,307
Ohio 6222	27.35	21.51	23.95	1,483
Wideawake	44.38	26.04	27.41	1,693

*7-year average.

TABLE 21.—VARIETIES OF WHEAT, YIELD PER ACRE

Variety	1920	1921	8-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Nigger	19.39	19.76	17.53	1,541*
Mediterranean	.....	18.68	17.16	1,674*
Rudy	16.31	19.35	15.41	1,549
Turkey Red	11.55	.....	11.89	1,202†
Gladden	18.05	18.14	18.04	1,825
Portage	13.30	18.60	15.86	1,413
Velvet Chaff	14.72	16.72	16.03	1,490
Trumbull	10.89	18.22	12.18	1,113†

*7-year average.
†6-year average.

TABLE 22.—DATE OF SEEDING WHEAT, YIELD PER ACRE

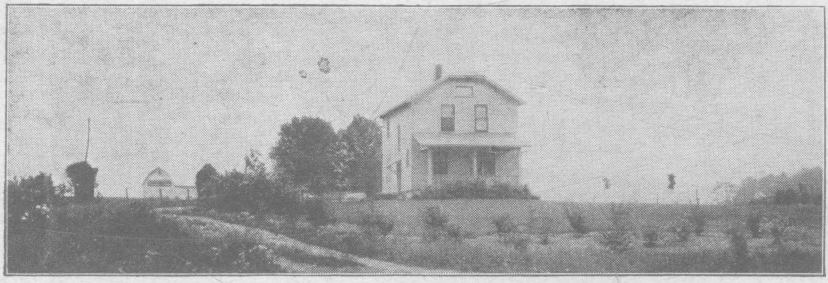
Date of Seeding	1915	1916	1917	1918	1919	1921	6-year average	
							Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
September 1	.....	2.17	*	.....	23.33	.....	8.50†	923†
September 8	16.00	2.50	*	.....	29.00	.....	11.87‡	1,212‡
September 15	22.50	6.58	11.33	11.33	29.67	.....	16.28§	1,424§
September 22	13.17	4.83	8.67	20.33	31.33	17.83	16.03	1,590
September 29	28.33	6.83	6.33	16.67	29.67	17.17	17.50	1,671
October 5 and 6	34.17	13.33	5.00	12.33	26.33	24.67	19.30	1,725
October 12	32.17	12.33	4.00	16.00	25.00	20.00	18.25	1,813
October 19	.....	5.67	4.33	15.33	26.00	22.83	14.83§	1,450§
October 26 to 30	15.83	5.00	8.67	13.00	13.67	21.67	12.97	1 348

*Entire failure.
†3-year average.
‡4-year average.
§5-year average.

TABLE 23.—VARIETIES OF SOYBEANS, YIELD PER ACRE

Variety	1915	1916	1917	1918	1919	1920	1921	7-year average	
								Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Elton	5.95	7.61	5.21	9.47	7.54	9.17	5.83	7.26	1,179
Midwest*	7.62	10.44	7.60	7.03	8.82	15.39	12.67	9.94	1,779
Ebony	6.23	3.56	8.21	9.25	10.48	12.22	14.28	9.18	1,371
Onio 9100	2.78	4.06	4.88	8.69	8.04	8.16	7.00	6.23	1,036
Hamilton (Ohio 9035)	6.84	4.78	7.21	5.58	4.93	9.11	8.39	6.69	1,466
Medium Green	7.12	5.67	3 54	8.08	5.54	7.17	8.00	6.45	1,227
New Era Cowpea	.....	0.33	1.50	.....	2.33	1.00	7.67	2.57†	1,356†

*Correct name for Mongol, Hollybrook, Roosevelt, and Medium Yellow.
†5-year average.



Foreman's Residence, Clermont County Experiment Farm

Ditching on Clermont County Experiment Farm, 1921

BULLETIN
OF THE
Ohio Agricultural Experiment Station
NUMBER 361 JUNE, 1922

COUNTY EXPERIMENT FARMS IN OHIO

PART IV

THE HAMILTON COUNTY EXPERIMENT FARM

NINTH AND TENTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

W. EDWIN WEAVER, SUPERINTENDENT
C. D. ADAMS, HORTICULTURAL FOREMAN
J. M. GREENE, DAIRY FOREMAN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$25,000.00	$25,000.00
Permanent improvements to March 1, 1920 and 1921	9,956.35	12,041.86
Permanent improvements made during year ended March 1, 1921: Horse barn, $89.38; drainage, $1,942.59; water supply, $45.26; scales, $8.28—total	2,085.51	
March 1, 1922: Hog house, $13.13; water trough, $9.65; men's toilet, $12.32; house No. 2, $35.01; dairy barn, $21.87; fences, $175.30; scales, $267.01; plantings, $48.87—total		583.16
Total permanent investment	$37,041.86	$37,625.02
Operating equipment:		
Livestock:		
March 1, 1921: horses, $975; cattle, $1,320; hogs, $500—total	$ 2,795.00	
March 1, 1922: horses, $600; cattle, $1,435; hogs, $415—total		$ 2,450.00
Machinery, tools, and harness	2,641.00	2,657.00
Crops and feeds:		
March 1, 1921: corn, $360; oats, $165; straw, $10; soybeans, $400; hay, $165; wheat, $180; silage, $190; mill feed, $105; tankage, $60; potatoes, $200—total	1,835.00	
March 1, 1922: corn, $165; oats, $88; hay, $600; straw, $24; silage, $123; potatoes, $105; soybeans, $80; mill feed, $70; salt, $2—total		1,257.00
Seeds	97.00	95.00
Fertilizer	120.00	320.00
Drain tile	65.00	44.00
Building material	165.00	85.00
Fence material	80.00	319.00
Dairy equipment	55.00	205.00
Hog equipment	25.00	501.00
Bedroom equipment	30.00	50.00
Spray material	35.00	20.00
Sundries	79.00	40.00
Total operating equipment	$ 8,022.00	$ 8,043.00
Total investment	45,063.86	45,668.02

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$ 2,000.00	$ 2,000.00
From Farm sales:		
Livestock and products:		
1920—Horses, $205; cattle, $199.63; hogs, $1,550.45; butterfat, $1,340.86; milk, $3; calves, $162.45; livestock fees, $5—total	3,466.39	
1921—Colts, $175; hogs, $793.84; cattle, $55.77; calves, $37.25; butterfat, $694.33; fees, $10.40—total		1,766.59
Crops:		
1920—Corn, $8.81; oats, $30.84; potatoes, $369.16; soybeans, $241.25; hay, $472.39; straw, $122.31; barley, $3.75; wheat, $2,387.81; stover, $22; apples, $512.23; sweet corn, $25.15; cabbage, $131.64—total	4,327.34	
1921—Oats, $28.78; rye, $42.97; wheat, $432.75; hay, $139.40; straw, $47.45; potatoes, $150.65; soybeans, $208.52; sweet corn, $57.17; stover, $7; tomatoes, 85 cents; cabbage, $125.07; turnips, 75 cents; seeds, $30.77—total		1,272.13
Sundries	54.59	23.49
Old implements	37.00	
Oak tree	48.00	
Total receipts	$ 9,933.32	$ 5,062.21
Balance brought forward	132.59	2,009.19
	$10,065.91	$ 7,071.40

Cr.

By Expenditures

For labor	$ 3,298.93	$ 3,519.98
For permanent improvements:		
1920—Building material, $65.40; concrete work, $23.98; drainage, $1,942.59; water supply, $45.26; gravel and saw bill, $92.37—total	2,169.60	
1921—Building material, $335.17; concrete work, $73.10; fence, $138.35; gravel, $2.50; plantings, $39.76; scales, $236.65—total		825.53
For machinery, tools, and harness	21.50	477.47
For livestock:		
1920—Cattle	10.85	
1921—Cattle, $126.04; hogs, $53.85—total		179.89
For current expenses	2,555.84	2,025.99
Total expense	$ 8,056.72	$ 7,028.86
To agree with Auditor		1.36
Balance forward	2,009.19	41.18
	$10,065.91	$ 7,071.40

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of farm in acres	1920	1921
Area cultivated	120.08	120.02
Area of farmstead	6.55	4.20
Permanent pasture	39.63	39.63
Orchard	16.01	13.93
Woodlot	27.25	27.25
Road (public)	6.44	7.44
Roads (farm)	6.39	6.55
Waste	.....	4.33
Total area of farm	223.35	223.35

Plot Work

Crop	1920			1921		
	Number of plots	Acres	Yield per acre	Number of plots	Acres	Yield per acre
Corn	26	2.6	55.7 bu.	26	2.6	47.2 bu.
Oats	11	1.1	71.7 bu.	11	1.1	34.8 bu.
Soybeans	25	2.5	26.6 bu.	25	2.5	18.8 bu.
Potatoes	13	.65	47.6 bu.	13	.65	54.6 bu.
Wheat (spring)	1	.1	25.0 bu.	1	.1	11.8 bu.
Wheat	39	3.25	22.9 bu.	39	3.25	20.7 bu.
Barley	1	.1	30.8 bu.	1	.1	8.1 bu.
Cowpeas	1	.1	2.6 bu.	1	.1	4.0 bu.
Hay (clover)	13	1.5	1.2 tons	26	1.95	1.7 tons
Hay (alfalfa)	22	1.42	2.2 tons	9	.6	3.5 tons
Hay (soybean)	13	.65	1.8 tons	.....	.....	.....
Total	165	13.97	.....	152	12.95	.....

Field Crops

	1920		1920	
	Acres	Yield per acre	Acres	Yield per acre
Corn	16	60.3 bu.	19.1	40.4 bu.
Oats	19.72	48.5 bu.	10.	25.4 bu.
Soybeans	3.	16.2 bu.	.....	.....
Potatoes	1.35	176.4 bu.	2.	61.7 bu.
Wheat	23.5	20.0 bu.	10.5	25.3 bu.
Hay (clover)	27.	1.4 tons	43.12	2.0 tons
Hay (alfalfa)	1.25	1.4 tons	1.	1.2 tons
Sweet corn (ears sold)	2.	700 doz.	2.16	1,384 doz.
Sweet corn (husked)	.....	280 doz.	.....	.....
Corn (silage)	7	7.3 tons	9.	7.3 tons
Corn (forage)	.....	.....	1.6	2.6 tons
Rye	.....	.....	2.8	21.8 bu.
Cabbage	2.16	5 tons	1.	1.9 tons
Hay (oat, pea, and vetch)	.....	.....	1.	1.2 tons
Corn, soys, and rape	.....	.....	1.	hogged down
Hay (oat and pea)	.5	3.1 tons	.5	1.2 tons
Oats (nurse crop)	.....	.....	1.64	clipped
Soybean hay (orchard)	.....	.....	4.4	.6 ton
Truck	.....	.....	.65	.....
Hay (soybean)	1.5	1.5 tons	.....	.....
Corn (hogged off)	1.	52.8 bu.	.....	.....
Hay (oats)	.5	1.4 tons	.....	.....
Soybeans, variety orchard (forage)	2.	8. tons	.....	.....
Soybeans, variety orchard (seed)	2.	20. bu.	.....	.....
Total	110.48	.....	111.47	.....
Less soybeans in orchard	4.	.....	4.4	.....
	106.48	.....	107.07	.....

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

		Corn	Oats	Soybeans	Potatoes	Wheat	Mixed hay	Alfalfa hay	Soybean hay
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*
Highest	1920	71.5	78.7	30.8	64.7	40.3	2.9	6.1	2.
	1921	79.1	40.6	29.1	52.3	34.3	2.5	4.0	.....
Lowest	1920	41.2	46.2	20.0	20.0	11.6	.7	3.6	1.
	1921	24.3	30.0	11.1	11.0	10.8	.8	3.0	.....

LABOR

For the year	1920	1921
Number of work horses	6	6
Number of crop acres per work horse	20.77	20.74
Number of man-hours for year beginning March 1	11,941.5	12,114
Number of horse-hours for year beginning March 1	5,734	5,605
Number of tractor-hours for year beginning March 1	284	287

ITEMIZED CURRENT EXPENSES

	1920	1921		1920	1921
Seeds	$ 167.58	$ 244.10	Fence maintenance	$ 6.90	$ 6.02
Fertilizer	167.06	630.29	Water supply maintenance	9.34	19.33
Spray material	20.77	72.67	Implement repair	78.98	230.00
Binder twine	19.25	28.83	Engine maintenance	*329.39	46.13
Machinery hire	136.77	54.02	Transportation	140.04	27.00
Plot fixtures	1.30	2.25	Communication	100.42	51.50
Feed	960.59	187.46	Publicity	25.10	20.82
Horse shoeing	40.20	9.85	Office supplies	130.30	11.00
Livestock equipt.	49.23	22.10	Fuel and light	55.77	/
Veterinary service	.90	24.75	Misc. hardware	14.91	1.73
Service fees	30.00		Bedroom equipment	16.40	35.03
Livestock incident's	22.45	16.72	Containers		.75
Building mainten'ce	32.19	132.64	Gasoline and oil		150.80
			Total	$2,555.84	$2,025.99

*Includes gasoline and oil.

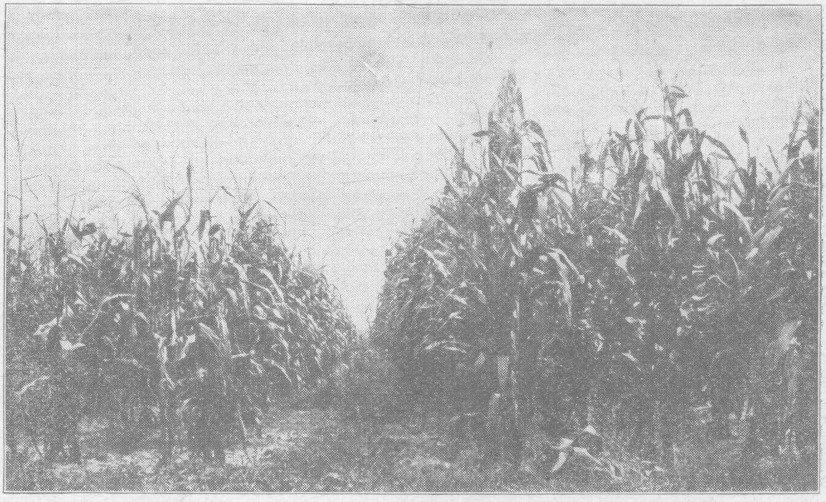
REPORT OF WORK FOR 1920 AND 1921

W. E. WEAVER

FIELD CROPS

Two three-year crop rotations—namely: ensilage corn-wheat-clover and field corn-oats-clover, as adapted to the needs of a dairy farm in southwestern Ohio are practiced on the Hamilton County Experiment Farm. The field going to corn is planted to ensilage corn on the half nearest the silo, the other half to field corn for husking. The ensilage corn is followed by wheat. The field corn is husked from the standing stalks. These are dragged or rolled down in the fall and the land disked to oats the following spring.

The grass seed mixture is sown in the spring on the wheat at two sowings and on the oats at the time they are planted. In 1921 the red clover was killed out but the alfalfa held. Red clover will be left out next year and the amount of alfalfa increased. The mixture will be, alfalfa 8 pounds, alsike 2 pounds, and timothy 4 pounds per acre. It is well to have some timothy in case the clovers should winter-kill.



Ensilage corn on Hamilton County Experiment Farm, 1921
Darke County Mammoth (Left), Eureka, (Right)

For ensilage corn Eureka has replaced Boone County White. The corn for husking is Darke County Mammoth. Portage wheat and Big Four oats are grown in this rotation.

In the fall of 1921 a shrinkage test of three varieties of corn was made, the object being to determine how much water must be

added to corn and stover at husking time to make it equal to ensilage in weight. A 100-hill shock of each variety, Eureka, Darke County Mammoth, and Boone County White, was cut and weighed at the silage stage, September 20, 6, and 6, respectively, and left to dry until husking time, October 18, and weighed again. The weights and shrinkage were as follows:

Variety	Green weight	Dry weight	Shrinkage	Shrinkage
	Lb.	*Lb.*	*Lb.*	*Percent*
Eureka (silage)	650	229	421	64.7
Darke County Mammoth	480	180	300	62.5
Boone County White	610	240	370	60.6

DAIRYING

Dairying and hog raising comprise the livestock work. Four registered heifers have been added to the initial herd of grade Jerseys with the object of determining whether a profitable and healthy herd of cows may be built up more economically and rapidly by keeping the heifers from good grade cows and a pure bred sire, or with registered heifers.

A record is kept of production and production costs. Table 1 gives the individual production record for the two years, beginning March 1, 1920 and ending February 28, 1922. Note that low producers are sold.

TABLE 1.—DAIRY PRODUCTION AND PRODUCTION COST

	1920				1921			
Cow	Milk	Test	Butterfat	Net over feed cost	Milk	Test	Butterfat	Net over feed cost
No.	*Lb.*	*Percent*	*Lb.*	*Dollars*	*Lb.*	*Percent*	*Lb.*	*Dollars*
1	4727.3	5 5	245.5	66.03	4994.4	5.3	266.07	50.81
2	4802.1	5.0	242.7	69.63	3509.1	4.5	159.05	14.96
3	4125.0	5.0	204.9	53.33	*	*	*	*
4	5569.0	5.0	279.4	115.84	5586.7	4.8	269.61	52.30
5	3679.0	5.0	181.1	35.60	3822.8	5.8	221.98	35.33
6	6960.0	5.0	360.1	143.13	5114.6	4.2	218.87	51.80
7	1645.0	5.0	82.3	—9.25	*	*	*	*
8	3860.0	4.6	170.2	37.75	*	*	*	*
9	6391.0	4.7	297.6	104.08	6013.5	4.7	283.38	60.85
10	5096.0	5.4	272.5	89.27	5435.1	5.1	280.38	59.41
11†				—22.82				
12‡	June 13, 1921, 8½ months' production				4744.6	5.6	267.86	56.94
14	November 13, 1921, 3½ months' production				1344.6	6.6	81.54	13.25
16†	December 23, 1921, 2¼ months' production				1634.4	4.6	76.45	16.02
18	June 1, 1921, 9 months' production				4427.6	5.1	229.03	42.11
19	November 18, 1921, 3½ months' production				3882.9	5.6	221.03	34.36
20	December 20, 1921, 2¼ months' production				1339.3	4.6	61.96	10.30

*Sold January, 1921. †Sold June 22, 1920. ‡Heifer number 12 is a daughter of number 9; and number 16, of number 1. Numbers 12, 14, and 16 are grade heifers; 18, 19, and 20 are registered Jerseys. The date following each number is for the birth of her first calf.

The cream and the veal calves are sold on the Cincinnati market, and the skimmilk is fed to calves and hogs.

The following summaries show the financial results of the two years' work.

FINANCIAL SUMMARY OF THE DAIRY WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Inventory March 1, 1920		Inventory February 28, 1921	
Land and dairy barn	$2,450.00	Land and dairy barn	$2,325.00
Milk house	112.50	Milk house	102.00
Equipment	243.00	Equipment	219.50
Livestock	1,535.00	Livestock	1,510.00
Total	$4,340 50	Total	$4,156.50
Expenses:		Receipts:	
Man-hours 2,085.5 at 34c	$ 689.69	Livestock sold	$ 375.30
Horse-hours 33.5 at 20c	6.70	Cream sold 2,003.2 lb. B. F.	1,340.86
Tractor-hours 19 at $1.50	28.50	Milk sold	3.00
Feeds*	1,661 63	Milk used 2,067 lb. at 4c	82.68
Equipment maintenance	39.57	Fees	5.00
Straw for bedding 5.9 T.	45.95	Skimmilk fed hogs 39,122 lb.†	293.41
		Skimmilk used 620 lb.†	4.65
		Manure produced‡	383.78
		To balance (loss)	167.36
Total	$6,812.54		$6,812.54

*Feed at monthly farm prices.
†Skimmilk 75 cents per hundred.
‡75 tons on pasture at $1.74 per ton, 73 tons in barn at $3.47.

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Land and dairy barn	$2,325.00	Land and dairy barn	$2,265.00
Milk house	102.00	Milk house	100.00
Equipment	219.50	Equipment	244.00
Livestock	1,510.00	Livestock	1,435.00
Total	$4,156.50	Total	$4,044.00
Expenses:		Receipts:	
Man-hours 1,992.5 at 32c	$ 637.60	Livestock sold	$ 93.02
Horse-hours 113 at 29c	32.77	Butterfat*	760.87
Tractor-hours 11 at $1.40	15.40	Skimmilk†	149.92
Livestock purchased	126.04	Whole milk	151.64
Feeds consumed‡	687.79	Manure	442.71
Equipment purchased	44.49	To balance (loss)	58 43
Total	$5,700.59	Total	$5,700.59

*Average price of butterfat 28.8 cents per pound.
†Average price of skimmilk 30.4 cents per cwt.
‡Feeds at monthly farm prices.

Fairland Prince Jewel No. 201, 357, was put at the head of the herd, replacing Sultan's Distinction Lad No. 170,125, in November, 1921.

An account of the costs of feeding a veal calf for market was kept, in July, 1921, in order to determine whether dairy calves are kept for veal at a profit or loss. The calf, when 31 days old and weighing 100 pounds, was sold at the stock yards for $8. Commission, yardage, and hauling costs were $2; labor feeding the calf $1.92; value of the milk fed $5.35. Total marketing, feed, and labor costs were $9.27; or $1.27 more than the selling price. A calf 33 days old and weighing 80 pounds was sold in December at 8 cents per pound, bringing $6.40. The marketing costs were $1.95; labor $1.25; milk fed $5.91, making a total cost of $9.14, a loss of $2.74.

These were Jersey bull calves, hand fed with fresh whole milk and some skimmilk.

ORCHARD WORK

The apple trees have made a vigorous growth, which, perhaps, may account for their tardiness in bearing. Some intertilled crops have helped pay the costs of cultivation. Table 2 gives costs of the orchards and receipts to date.

TABLE 2.—ORCHARD WORK, COSTS AND RECEIPTS

Date	Sod mulch 2.37 acres, 110 trees		Cultivated 2.37 acres, 110 trees		Variety 4.48 acres, 120 trees	
	Costs	Receipts	Costs	Receipts	Costs	Receipts
1912	$ 46.50		$ 46.50		$ 51.00	
1913-18	229.00		267.00		320.00	
1919	80.73	$ 7.50	104.71		150.43	$120.00*
1920	54.73	50.50	109.24	$136.45†	141.40	183.60‡
1921	79.97		100.77		116.61	29.90*
Total	$490.93	$58.00	$628.22	$136.45	$779.44	$333.50

*Receipt from soybean hay.
†$49.00 from soybeans.
‡$150 from soybeans and soybean forage.

HOG WORK

Duroc-Jersey hogs are kept, mainly to consume the skimmilk from the dairy. Corn is grown continuously on a one-acre block of land to be hogged down. Soybeans are planted in the west half, and rape is sown in the east half of the block.

The present herd boar was sired by Colonel King Perfect, grand champion at the Ohio State Fair in 1921. His dam was sired by Faust's Top Colonel, grand champion at the International Expcsition in 1920.

The results of hogging down corn for the two years are given in Table 3.

TABLE 3.—HOGGING OFF CORN IN 1920 AND 1921, PER ACRE BASIS

	1920	1921
Yield of corn in bushels as per dry samples	52.8	55.7
Price of corn per bushel	$ 1.00	$ .55
Value of corn on stalk at end of the period	$52.80	$30.63
Number of hogs in the test	33	27
Average initial weight of hogs, pounds	108.5	104
Number of days in the test	11	17
Pork produced, pounds	540	622
Gain per hog per day, pounds	1.54	1.35
Price of pork, cents per pound	17.5	7.8
Value of gain at end of the period	$94.50	$48.51
Value of supplemental feeds	$11.85	$ 2.92
Value of gain attributed to corn	$82.65	$45.59
Cost per pound of pork for feed only, cents	11.9	5.3
Profit per pound of pork for feed, cents	5.6	2.5
Returns per bushel of corn hogged off	$ 1.56	$ .818

Note: The supplemental feed in 1920 was tankage and skimmilk and in 1921 tankage only.

FINANCIAL SUMMARY OF THE HOG WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Inventory March 1, 1920		Inventory February 28, 1921	
Equipment and land	$ 337.00	Equipment and land	$ 658.50
Livestock	655.00	Livestock	500.00
Total	$ 992.00	Total	$1,158.50
Expenses:		Receipts:	
Man-hours 566 at 34c	192.44	Livestock	1,582.42
Horse-hours 20 at 20c	4.00	To balance (loss)	287.77
Feed	1,487.46		
Rent of land, 2 acres	20.00		
Installing water system	81.00		
Construction of feeding floors	158.00		
Building hurdles	4.00		
Construction of hog house	62.00		
Maintenance of equipment	27.80		
Total	$3,028.70		$3,028.70

Notes: Feeds were charged at farm price each month. Average selling price of hogs $13.90. Number of brood sows kept was 4; number of hogs sold, 59. No charges for overhead or interest on investment are made. The loss is mostly due to the lower price of hogs February 28, 1921.

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Equipment and land	$ 658.50	Equipment and land	$ 624.00
Livestock	500.00	Livestock	415 00
Total	$1,158.50	Total	$1,039 00
Expenses:		Receipts:	
Livestock purchased	$ 50.00	Livestock sold	$ 793.84
Equipment purchased	10.42	6 boar services	11.00
Feed	684.57	Experimental, 89 man-hours at 32c	28.48
Man-hours 358½ at 32c	114.72	Experimental, 8 horse-hours at 29c	2.32
Horse-hours 31 at 29c	8.99	To balance (loss)	199.10
Rent of land, 2 acres	20.00		
Miscellaneous	26.54		
Total	$2,073.74	Total	$2,073.74

Average prices for year: Corn (ear) 91 cents per cwt.; tankage $3.15; middlings $1.42; bran $1.50; clover hay $13.80 per ton; skimmilk 35 cents per cwt; man-labor 32 cents per hour; horse-labor 29 cents per hour; average selling price of hogs $7.25 per cwt.

COST ACCOUNT WORK

Cost account work with field crops for 1921 seems to show that while using the tractor reduces the man- and horse-hours in growing crops it does not decrease the total cost; that we can husk corn from the stalks cheaper than from the shock; that the only field that paid the labor and miscellaneous costs was the one hogged-down—that is, the price per bushel received for corn by marketing through hogs was more than the cash price of corn in the field; that, of the crops—corn, wheat, oats, and hay—grown in a field way, hay paid most per acre above labor and miscellaneous costs, wheat next, while oats and corn were grown at a loss. From one year's figures it would seem that a rotation of corn, wheat, and hay would pay better than one of corn, oats, and hay. However, a factor or two should be taken into consideration. If wheat follows corn usually the corn must be cut, while if oats follows it the corn

can be husked on the stalk. If oats follow corn there will be no labor charge for grass seeding as the grass seed may be sown with the drill while seeding the oats.

TRUCK WORK

In addition to sweet corn, cabbage, and potatoes, which are grown and sold on the market, a block has been used for variety tests of sweet corn, tomatoes, and cabbage for market, and variety soybeans for forage. Owing to the dry season of 1921 little information of value was obtained.

The Hoosier Boy gave the best yield in a variety test of late potatoes made in 1921. Bull Moose, Sir Walter Raleigh, and Petoskey, followed in order. The comparison of varieties is to be continued in 1922.

COST OF TILING

CARY W. MONTGOMERY

Much more tiling was done on the farm than accounted for in Table 4. But as it was done about the buildings and grove and out of the way places and as supplement to the drainage system previously installed, it would not be of value to farmers in determining the cost of a drainage system on their farms.

The general plan was outlined by the writer and the work was done under the supervision of H. W. Rogers who kept the cost account records. Credit for laying out the system is due the Department of Agricultural Engineering, Ohio State University. The laying out of the system was not paid for by the farm, but we have thought best to include an estimate charge for this work.

TABLE 4.—COST ACCOUNT OF TILING, 1920

	Block S, 1 acre	Field 3, 20 acres
Laying out drainage system:		
Man-hours at $1.00 per hour	$ 1.00	$ 25.00
Ditching:		
Man-hours at 40 cents per hour	7.40	241.80
Horse-hours at 20 cents per hour	2.60	61.80
Gasoline at 30 cents per gallon	2.10	36.60
Oil at 75 cents per gallon	.19	3.75
935 feet, 4-inch tile at 4.7 cents each	43.94	.....
22,914 feet, 4-inch tile at 4.7 cents each	.....	1,066.95
83 feet, 6-inch tile at 8.1 cents each	6.72	.....
2,723 feet, 6-inch tile at 8.1 cents each	.....	220.56
Sewer pipe Y's, T's, and curves	.25	94.88
Rent of ditching machine at 30 cents per rod	15.91	480.30
Overhead charges*	3.62	91.28
Total cost	$83.73	$2,322.92
Cost per acre	$83.73	$ 116.14
Cost per rod	1.31	1.45
Number rods of ditch	63.62	1,602.31
Distance between laterals in feet	40	36

*Including breakage of tile, freight on ditching machine, repairs, etc.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

Two rotations are in progress on this farm—namely:

Rotation I: Corn, soybeans, wheat, clover.
Rotation II: Potatoes, wheat, clover.

FERTILIZERS AND MANURE ON CROPS GROWN IN ROTATION

ROTATION I: CORN, SOYBEANS, WHEAT, AND CLOVER

The data for this experiment for 1920 and 1921 and the average results for the 9 years since the work was begun are given in the tables following.

The outcome of this experiment is summarized in Table 5, which gives the plan of fertilizing and the annual value of increase for each treatment, computing corn at half a dollar a bushel, soybeans at $1.25, wheat at $1.00, hay at $10.00 a ton; corn stover and soybean straw at $4.00 a ton, and wheat straw at $2.00 a ton.

Fertilizing materials are computed at $20.00 a ton for 16 percent acid phosphate, $60.00 a ton each for muriate of potash and nitrate of soda; $4.00 a ton for ground limestone and $1.00 a ton for manure, all spread on the field.

Computed in this way, acid phosphate and muriate of potash have each returned their cost with a balance of 200 percent for acid phosphate and nearly as large a percentage for the potash. Nitrogen in nitrate of soda has produced practically no increase in yield over that given by phosphorus and potassium. The balance from 10 tons of shed manure is nearly $4.00 greater than from the same quantity of open-yard manure. Computed at one dollar a ton, spread on the field, the balance from 10 tons of shed manure has been less than $1.00 greater than that from an expenditure of $7.70 in acid phosphate and muriate of potash. If the manure were charged only the actual cost of getting it from the stable to the field it would be more profitable than the chemicals, but if the manure be computed at the cost of hauling it out from the city all profit from its use, over that given by chemicals, will disappear.

The addition of acid phosphate to the manure has not materially increased the effect. Ground limestone, when added to phosphated manure, has increased the yield, but not sufficiently to justify the use of 2 tons of limestone per acre every 4 years at a cost of $4.00 a ton. It is probable, however, that this is an excessive use of limestone for this soil, and that this treatment may now be discontinued with a reasonable expectation that without

any further addition of limestone there will be an increase in the yield on this land that will last for a number of years and will finally justify the expenditure.

TABLE 5.—Plan of fertilizing, total value of increase, cost of treatment, and balance per acre for each rotation

Corn-soybeans-wheat-clover rotation

Plot	Treatment*	Pounds per acre on			Total cost of treatment	Total value of increase	Balance
		Corn	Soybeans	Wheat			
1	None						
2	Acid phosphate	200	100	200	$ 5.00	$15.08	$10.08
3	Acid phosphate	200	100	200			
	Muriate potash	50	20	20	7.70	21.58	13.88
4	None						
5	Acid phosphate	200	100	200			
	Muriate potash	50	20	20	12.50	22.40	9.90
	Nitrate soda	50	30	80			
6	Yard manure, untreated	5 tons		5 tons	10.00	20.59	10.59
7	None						
8	Shed manure, untreated	5 tons		5 tons	10.00	24.43	14.43
9	Shed manure, phosphated	5 tons		5 tons	14.00	24.99	10.99
10	None						
11	Shed manure, phosphated	5 tons		5 tons	22.00	31.69	9.69
	Ground limestone	2 tons					
12	Shed manure, phosphated	5 tons					
	Ground limestone	2 tons					
	Acid phoshate			200			
	Muriate potash			50	20.00	31.39	11.39
	Nitrate soda			50			
13	None						

Potatoes-wheat-clover rotation

Plot	Treatment*	Potatoes	Wheat	Total cost of treatment	Total value of increase	Balance
1	None					
2	Acid phosphate	200	200	$4.00	$10.54	$ 6.54
3	Acid phosphate	200	200			
	Muriate potash	50	50	7.00	18.51	11.51
4	None					
5	Acid phosphate	200	200			
	Muriate potash	50	50	10.00	15.35	5.35
	Nitrate soda	50	50			
6	Acid phosphate	400	400			
	Muriate potash	100	100	20.00	25.64	5.64
	Nitrate soda	100	100			
7	None					
8	Manure	8 tons	8 tons	16.00	29.39	13.39
9	Acid phosphate	200	200			
	Manure	8 tons	8 tons	20.00	40.48	20.48
10	None					
11	Acid phosphate	200	200			
	Muriate potash	50	50	23.00	34.23	11.23
	Manure	8 tons	8 tons			
12	Acid phosphate	200				
	Manure	8 tons		10.00	27.99	17.99

*The fertilizers, including the nitrate of soda, are applied just before planting the crop. The manure is plowed under for corn, but applied as a top dressing for wheat. The "phosphated" manure is treated with 40 pounds of acid phosphate per ton of manure, the phosphate being mixed with the manure before spreading.

The lower prices for produce now prevailing make the margin between cost of fertilizers and value of increase much narrower than it was at the close of the Great War.

THE POTATOES-WHEAT-CLOVER ROTATION

The plan of this experiment is shown in Table 5. The beginning of the test was delayed until 1913, in order to drain the land, and the work on Plots 11, 12, and 13 was not started until 1916, which accounts in part for the lower yields on these plots. The outcome to the end of 1921 is shown in Tables 10, 11, and 5.

The yields of potatoes in this experiment, as in the similar one in Clermont County, have been discouragingly low and uncertain, and the question has been raised whether the planting of potatoes should not be deferred until midsummer. As this change would prevent the following of potatoes with wheat, it seems worth while to make further effort to overcome the difficulties besetting this crop; and, while it is planned to undertake experiments in late planting, it seems desirable to continue this experiment for a few years longer before making any radical change.

The Census statistics for 1919 show that in that year potatoes occupied 6,827 acres in Hamilton County, a larger area than in any other county in the State, Cuyahoga coming next with 5,506 acres. In Hamilton County potatoes are grown chiefly on the more fertile valley and terrace lands. The average yield per acre for the 8 years during which the experiment under consideration has been in progress has been nearly 89 bushels, as shown by the statistics collected by the township assessors. In this experiment the average yield on the unfertilized land has been nearly 61 bushels; but it has been raised to 93 bushels for the average of the four manured plots.

Acid phosphate, when used alone, appears not to have increased the yield of potatoes, although it seems to have increased the effectiveness of the manure. The apparent falling off in effect on Plots 11 and 12, as compared with 8 and 9, is due to the fact that the work on these plots was not begun until 1916. The yields had been large in 1914 and 1915. If these years be omitted the average yields for Plots 8, 9, 11, and 12 would be 72.17, 81.00, 82.03, and 79.97 bushels, respectively, showing a considerable increase for the reinforced manure over that used alone, and also suggesting that the large dressing of 16 tons has been used wastefully.

The addition of potash to acid phosphate, on Plot 3, has increased the yield, but the 16 tons of manure given to Plot 11 has apparently carried all the potash required.

Comparison of the two rotations.—In Table 11 an attempt is made at a comparison of the financial outcome in the two rotations. The experiments are located side by side, in the same original field,

which was as nearly uniform in topography, soil, and history as it was possible to select. The relative yields are found by adding the increase for each treatment to the average unfertilized yield, thus eliminating part of the error due to the variations which occur even in the most uniform soils. The values are computed by adding the stover or straw to the grain, at the prices quoted on page 424. The estimated cost of seed is added to that of fertilizers, manure, and lime, because the seed for the potato crop is much more expensive than that for corn or soybeans. No attempt is made at computing the difference in cost of labor on the different crops, nor for rental of land.

As the figures stand they show that the wheat has yielded nearly 60 percent more on the manured or fertilized land and more than 90 percent more on the unfertilized land when grown after potatoes than after soybeans, though other experiments have shown that wheat following soybeans will generally yield more than that following oats or corn.

Table 11 shows that on several plots in this experiment the wheat has averaged more than 38 bushels per acre for 7 years, an outcome in harmony with the results in the similar experiment at Wooster, in which the wheat has maintained an average yield under certain treatments of 38 bushels per acre for 25 years.

FERTILIZERS AND MANURE ON ALFALFA

In August, 1914, a tract of nine plots was sown in alfalfa and fertilized and manured according to the plan shown in Table 13. The treatments were all given at the time of seeding and have not been repeated since. At the same time 2 tons of limestone per acre was applied to half the land, the liming being across the plots, and half the land through the middle was inoculated with sweet clover soil. As neither the liming nor the inoculation caused any perceptible difference in the alfalfa it was not harvested separately for these treatments. The effect of the fertilizer and manure treatments is shown in Table 13, which gives the entire amount of fertilizer and manure applied and the total yield and increase for each treatment for the seven years.

It does not seem probable that the addition of nitrate of soda to the fertilizer would reduce the yield, and until there is further evidence on this point we must conclude that the reduction on Plot 4 is due to soil variation. With this exception the results show a fairly consistent increase for the two applications of acid phosphate, and a decided increase when potash is added, either in the muriate or in manure.

It is interesting to study the duration of the effect of the single treatment made at the beginning of this test. This is done in Table 14, which shows the average annual total yield per acre for each treatment for the period terminating with the year given. That is, the figures opposite 1916 are 2-year averages; those opposite 1917 are 3-year averages, etc.

This table shows that the yields are slowly decreasing under all the treatments, but that the effect of the treatments is still manifest in larger yields on the treated than on the untreated land.

TABLE 6.—Fertilizers, manure, and lime on CORN grown in rotation with soybeans, wheat, and clover, Hamilton County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on corn	1920—Block C				1921—Block D				9-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	
		Bu.	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	
1	None	47.57	1,850	.....	.....	35.86	2,040	.....	.....	40.06	2,353	.....	.....	1
2	Acid phosphate, 200 lb	54.00	2,090	5.38	190	38.00	2,250	3.95	297	45.20	2,455	4.34	99	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	64.43	2,590	14.77	640	42.00	2,590	9.76	723	54.16	2,636	12.50	277	3
4	None	50.71	2,000	.....	.....	30.43	1,780	.....	.....	42.47	2,362	.....	.....	4
5	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.	66.43	2,520	14.39	373	39.86	2,510	9.72	807	52.94	2,696	10.00	358	5
6	Yard manure, untreated, 5 tons	68.43	2,640	15.05	347	48.00	2,240	18.14	613	55.28	2,717	11.88	403	6
7	None	54.71	2,440	.....	.....	29.57	1,550	.....	.....	43.88	2,291	.....	.....	7
8	Shed manure, untreated, 5 tons	71.57	2,450	18.33	77	37.71	2,020	9.90	477	59.03	2,812	15.31	512	8
9	Shed manure, phosphated, 5 tons*	69.29	2,510	17.53	203	38.29	2,290	12.24	753	58.37	2,869	14.81	557	9
10	None	50.29	2,240	.....	.....	24.29	1,530	.....	.....	43.41	2,320	.....	.....	10
11	Shed manure, phosphated, 5 tons; ground limestone, 2 tons	67.00	2,710	19.71	650	25.87	1,800	.77	230	57.77	3,051	17.56	833	11
12	Shed manure, phosphated, 5 tons; ground limestone, 2 tons	68.29	2,500	24.00	620	32.43	1,870	6.53	260	55.56	2,880	18.56	765	12
13	None	41.29	1,700	.....	.....	26.71	1,650	.....	.....	33.79	2,012	.....	.....	13
	Average unfertilized yield	48.91	2,046	.....	.....	29.37	1,710	.....	.....	40.72	2,379	.. ....	.....	
	Average fertilized yield	66.18	2,501	.....	.....	37.77	2,798	... ...	.....	54.79	2,764	.....	.....	

*40 lb. acid phosphate per ton of manure.

TABLE 7.—Fertilizers, manure, and lime on SOYBEANS grown in rotation with corn, wheat, and clover, Hamilton County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on soybeans	1920—Block B				1921—Block C				8-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	
		Bu.	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.**	*Bu.*	*Lb.**	*Bu.*	*Lb.*	*Bu.*	*Lb.*	
1	None	22.83	1,580	.....	.....	9.66	.....	.....	.....	12.34	1,618	.....	.....	1
2	Acid phosphate, 100 lb	26.00	2,240	2.78	817	13.69	.....	2.69	.....	14.75	1,827	2.00	284	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	27.00	1,580	3.39	313	13.55	.....	1.20	.....	15.67	1,699	2.50	231	3
4	None	24.00	1,110	.....	.....	13.69	.....	.....	.....	13.59	1,393	.....	.....	4
5	Acid phos., 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.	26.17	1,680	1.95	367	16.86	.....	2.74	.....	16.06	1,708	2.24	280	5
6	Yard manure on corn	30.83	1,150	6.38	—367	16.29	.....	1.73	.....	15.90	1,464	1.85	0	6
7	None	24.67	1,720	.....	.....	14.99	.....	.....	.....	14.28	1,499	.....	.....	7
8	Shed manure on corn	27.33	1,760	2.11	7	16.72	.....	2.16	.....	15.70	1,890	1.51	378	8
9	Shed manure, phosphated, on corn	28.17	1,560	2.39	—227	15.86	.....	1.74	.....	16.33	1,731	2.24	207	9
10	None	26.33	1,820	.....	.....	13.69	.....	.....	.....	13.99	1,536	.....	.....	10
11	Shed manure, phosphated, and limestone on corn	27.50	1,650	3.28	—130	17.59	.....	4.81	.....	16.09	1,597	2.88	136	11
12	Shed manure and limestone on corn, fertilizers on wheat	28.67	2,030	6.56	290	15.14	.....	3.28	.....	14.96	1,654	2.53	269	12
13	None	20.00	1,700	.....	.....	10.95	.....	.....	.....	11.65	1,309	.....	.....	13
	Average unfertilized yield	23.57	1,586	.....	.....	12.60	.....	.....	.....	13.17	1,471	.....	.....	
	Average fertilized yield	27.71	1,706	.....	.....	15.71	.....	.....	.....	15.68	1,696	.....	.....	

*Soybean haulm was not reported in 1921.

TABLE 8.—Fertilizers, manure, and lime on WHEAT grown in rotation with corn, soybeans, and clover, Hamilton County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre on wheat	1920—Block A				1921—Block B				8-year average				Plot No.
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	
1	None	11.67	1,050			10.83	1,050			12.63	1,345			1
2	Acid phosphate, 200 lb	22.00	1,830	8.83	653	15.33	1,230	4.61	173	20.67	1,932	7.40	558	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb	24.63	2,310	9.96	1,007	15.83	1,750	5.22	687	21.91	2,093	8.01	688	3
4	None	16.17	1,430			10.50	1,070			14.53	1,434			4
5	Acid phos., 200 lb.: mur. potash, 20 lb.; nit. soda, 80 lb.	26.33	2,420	10.38	793	20.17	1,840	8.95	730	24.54	2,314	9.41	791	5
6	Yard manure, untreated, 5 tons	19.33	1,740	3.61	—83	19.17	2,050	7.22	900	20.33	2,159	4.61	546	6
7	None	15.50	2,020			12.67	1,190			16.32	1,702			7
8	Shed manure, untreated, 5 tons	20.00	2,050	4.94	—47	21.50	2,610	9.05	1,223	21.49	2,298	5.57	570	8
9	Shed manure, phosphated, 5 tons	23.33	1,600	8.72	—573	25.00	2,400	12.78	817	24.16	2,417	8.65	663	9
10	None	14.17	2,250			12.00	1,780			15.12	1,781			10
11	Shed manure, phosphated, 5 tons	25.67	1,760	10.72	—343	25.17	1,890	12.50	217	23.68	2,554	10.05	864	11
12	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb. (Phosphated manure and limestone on corn)	26.33	2,020	10.61	63	23.50	2,490	10.17	923	26.88	2,699	12.26	1,098	12
13	None	16.50	1,810			14.00	1,460			14.37	1,552			13
	Average unfertilized yield	14.80	1,724			12.00	1,310			14.60	1,559			
	Average fertilized yield	23.45	1,966			20.71	2,032			22.96	2,308			

TABLE 9.—Residual effect of fertilizers, manure, and lime on CLOVER grown in rotation with corn, soybeans, and wheat, Hamilton County Experiment Farm. Yield and increase per acre

Plot	Total fertilizing materials applied to previous crops of rotation	1920, Block D		1921, Block A		7-year average		Plot
		Yield	Increase	Yield	Increase	Yield	Increase	
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	
1	None	1,211		2,335		2,826		1
2	Acid phosphate, 500 lb	1,211	—173	3,200	865	3,222	325	2
3	Acid phosphate, 500 lb.; muriate potash, 90 lb	1,557	0	3,114	779	3,471	501	3
4	None	1,730		2,335		3,041		4
5	Acid phosphate, 500 lb.; muriate potash, 90 lb.; nitrate soda, 160 lb	2,335	519	3,373	1,096	3,678	627	5
6	Yard manure, untreated, 10 tons	3,978	2,075	3,719	1,499	4,339	1,278	6
7	None	1,989		2,162		3,072		7
8	Shed manure, untreated, 10 tons	3,459	1,325	3,892	1,442	4,584	1,397	8
9	Shed manure, phosphated, 10 tons*	3,200	923	3,114	375	4,095	793	9
10	None	2,422		3,027		3,418		10
11	Shed manure, phosphated,* 10 tons; ground limestone, 2 tons	5,016	2 796	2,947	—80	4,574	1,294	11
12	Shed manure, phosphated,* 5 tons; ground limestone, 2 tons; acid phosphate, 200 lb.; muriate potash, 50 lb.; nitrate soda, 50 lb	2,940	922	3,632	605	3,847	706	12
13	None	1,816		3,027		3,003		13
	Average unfertilized yield	1,833		3,222		3,164		
	Average fertilized yield	2 962		3,374		3,976		

*40 lb. acid phosphate per ton of manure.

TABLE 10.—Fertilizers and manure on POTATOES and CLOVER grown in rotation with wheat, Hamilton County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on potatoes	Potatoes						Clover*						Plot
		1920—Block K		1921—Block L		8-year average		1920—Block L		1921—Block M		4-year average		
		Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	
1	None	30.00	.....	11.00	.....	72.00	.....	2,076	.....	2,422	.....	4,014	.....	1
2	Acid phosphate, 200 lb	40.33	10.89	16.67	5.00	65.75	—.16	2,767	403	3,460	692	4,367	229	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	56.67	27.78	15.33	3.00	69.58	9.76	3,286	634	3,979	865	4,688	426	3
4	None	28.33	.....	13.00	.....	53.73	.....	2,940	.....	3,460	.....	4,385	.....	4
5	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.	54.00	22.89	23.67	7.89	71.37	15.17	3,113	173	2,249	—865	4,282	—74	5
6	Acid phos., 400 lb.; mur. potash, 100 lb.; nit. soda, 100 lb.	60.33	26.44	37.67	19.12	85.96	27.27	3,286	346	2,768	0	4,502	174	6
7	None	36.67	.....	21.33	.....	61.17	.....	2,940	.....	2,422	.....	4,299	.....	7
8	Manure, 8 tons	61.00	28.89	50.00	26.11	99.56	34.97	3,459	404	2,739	0	5,001	718	8
9	Manure, 8 tons; acid phosphate, 200 lb	68.00	40.44	52.33	25.89	113.14	45.12	3,459	288	3,720	664	5,648	1,382	9
10	None	23.00	.....	29.00	.....	71.46	.....	3,286	.....	3,373	.....	4,249	.....	10
11	Manure, 8 tons; acid phos., 200 lb.; mur. potash. 50 lb.	72.00	49.00	48.33	22.55	82.03	36.34	4,151	865	3,114	1,557	5,382	1,108	11
12	Manure, 8 tons; acid phosphate, 200 lb.	66.00	43.00	47.00	24.45	79.97	34.42	4,151	865	4,411	.....	4,990	692	12
13	None	23.00	.....	19.33	.....	45.45	.....	3,286	.....	2 595	.....	4,324	.....	13
	Average unfertilized yield	28.20	.....	18.73	.....	60.76	.....	2,906	.....	2,855	.....	4,254	.....	
	Average fertilized yield	59.79	.....	36.37	.....	84.04	.....	3,459	.....	2,822	.....	4,857	.....	

*In 1919 and 1920 the clover in this experiment failed and soybeans were grown instead and harvested for hay.

TABLE 11.—Fertilizers and manure on WHEAT grown in rotation with potatoes and clover, Hamilton County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on wheat	1918—Block M				1919—Block K				7-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	
		Bu.	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	
1	None	25.67	3,060	.....	.....	24.00	3,760	.....	.....	26.95	3,577	.....	.....	1
2	Acid phosphate, 200 lb	36.00	5,340	8.33	2,300	30.00	3,200	5.89	—287	35.76	4,569	8.41	1,069	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	39.33	4,540	9.66	1,520	30.33	3,580	6.11	367	38.38	4,283	10.64	860	3
4	None	31.67	3,000	.....	.....	24.33	2,940	.....	.....	28.14	3,346	.....	.....	4
5	Acid phos., 200 lb.; mur. potash, 50 lb.; nit. soda, 50 lb.	40.33	4,280	10.11	1,193	29.33	2,840	4.67	—13	35.36	4,321	6.89	880	5
6	Acid phos.; 400 lb.; mur. potash, 100 lb.; nit. soda, 100 lb.	39.67	4,520	10.89	1,347	27.67	3,540	2.67	773	38.60	4,881	9.80	1,344	6
7	None	27.33	3,260	.....	.....	25.33	2,680	.....	.....	29.12	3,633	.....	.....	7
8	Manure, 8 tons	34.67	3,920	8.56	887	32.00	3,480	6.22	693	36.09	4,706	7.22	1,097	8
9	Manure, 8 tons; acid phosphate, 200 lb	35.33	4,880	10.44	2,073	34.00	4,560	7.78	1,667	38.07	5,141	9.45	1,557	9
10	None	23.67	2,580	.....	.....	26.67	3,000	.....	.....	28.38	3,560	.....	.....	10
11	Manure, 8 tons; acid phos., 200 lb.; muriate potash, 50 lb.	37.00	4,780	12.11	2,007	32.67	3,640	6.73	560	39.03*	4,978	9.28	1,237	11
12	Manure and acid phosphate on potatoes only	35.33	3,580	9.22	613	31.67	2,700	6.56	—460	35.83*	4,530	6.28	1,041	12
13	None	27.33	3,160	.....	.....	24.33	3,240	.....	.....	29.33*	3,238	.....	.....	13
	Average unfertilized yield	27.13	3,012	.....	.....	24.93	3,124	.....	.....	28.39	3,471	.....	.....	
	Average fertilized yield	37.21	4,480	.....	.....	30.96	3,442	.....	.....	37.14	4,676	.....	.....	

*Plots 11, 12, and 13 four-year average.

TABLE 12.—Comparison of financial outcome in different rotations, Hamilton County Experiment Farm

Plot No.	*	2	3	5	6	8	9	11	12
Cereal rotation									
Corn, annual value	$25.12	$27.49	$31.92	$30.83	$31.86	$33.79	$33.63	$35.56	$35.93
Soybeans, annual value	19.40	22.47	22.98	22.76	21.71	22.04	22.61	23.27	23.09
Wheat, annual value	16.16	24.12	24.86	26.36	21.31	22.30	25.47	27.07	29.52
Clover, annual value	15.82	17.44	18.32	18.95	22.21	22.80	19.78	22.29	19.35
Average annual value	19.12	22.88	24.52	24.72	24.27	25.23	25.37	27.05	26.97
Cost of seed and treatment	1.25	2.50	3.18	4.38	3.75	3.75	4.75	6.75	6.25
Balance	17.87	20.38	21.34	20.34	20.52	21.48	20.62	20.30	20.72
Potato rotation									
Potatoes, annual value	30.38	30.30	35.26	37.96	44.01	47.86	52.94	48.55	47.59
Wheat, annual value	31.86	41.34	43.36	39.63	43.00	40.18	42.87	42.38	39.18
Clover, annual value	21.62	22.76	23.75	21.25	22.49	25.21	28.53	27.16	25.08
Average annual value	27.95	31.47	34.12	32.95	36.50	37.75	41.45	39.36	37.28
Cost of seed and treatment	5.00	6.00	7.33	8.33	11.67	10.33	11.67	12.67	8.33
Balance	22.95	25.47	26.79	24.62	24.83	27.42	29.78	26.69	28.95

*Average of unfertilized plots.

TABLE 13.—Fertilizers and manure on ALFALFA. Total treatment, total produce, and total increase for 7 years. Hamilton County Experiment Farm

Plot	Treatment per acre. All applied at the beginning of the test	Total produce	Total increase
		Tons	*Tons*
1	None	24.0	
2	Acid phosphate, 400 lb	25.0	0.9
3	Acid phosphate, 400 lb.; muriate potash, 75 lb	28.1	3.9
4	Acid phosphate, 400 lb.; muriate potash, 75 lb.; nitrate soda, 75 lb	23.6	—0.7
5	None	24.3	
6	Acid phosphate, 800 lb	25.5	1.5
7	Phosphated manure,* 10 tons	30.1	6.5
8	Untreated manure, 10 tons	26.9	3.7
9	None	22.9	

*40 lb. acid phosphate per ton of manure.

TABLE 14.—Fertilizers and manure on ALFALFA. Average annual yield per acre for each treatment for the period ending with the date given. Hamilton County Experiment Farm

Period ending	Plot numbers and average yield in tons per acre									
	1	2	3	4	5	6	7	8	9	*
1915	4.27	3.50	5.47	3.93	4.22	4.06	5.99	4.11	2.68	3.70
1916	3.79	3.73	4.76	3.96	3.85	4.24	5.39	4.23	2.90	3.51
1917	3.53	3.49	4.26	3.66	3.60	3.97	4.94	3.94	3.02	3.38
1918	3.22	3.27	3.94	3.43	3.34	3.72	4.47	3.70	2.96	3.17
1919	3.40	3.38	3.96	3.41	3.43	3.73	4.32	3.67	3.00	3.28
1920	3.57	3.64	4.14	3.49	3.61	3.68	4.51	3.91	3.30	3.49
1921	3.43	3.57	4.02	3.37	3.47	3.64	4.31	3.85	3.26	3.39

COMPARISON OF VARIETIES

DEPARTMENT OF AGRONOMY

CORN

Six varieties of corn have been tested for 9 years, one for 8 years, one for 7 years, and one for 6 years. Of those tested for the full 9-year period, Darke County Mammoth yielded highest, Reid (Orcutt) second, and Cook's 75—a strain of Reid's—third. For the 6 years tested, Connor's Prolific yielded 61.58 bushels of ear corn per acre but was less mature and carried more water than the other varieties. Its yield of stover is almost double the other sorts tested. The local strain of Clarage has outyielded the northern grown seed every year tested but one, 1921.

OATS AND OTHER SPRING CEREALS

Seven varieties of oats and one of barley have been tested for the full period of 9 years. Table 16. Of these, Big Four has the largest yield, Silver Mine second, and Ohio 6222—a selection from the Improved American—third. Barley yielded 22.07 bushels, which is equal to a yield of 33.10 bushels of oats—a bushel of barley weighing 48 pounds and one of oats 32 pounds. The 4-year average yield of Albion (Iowa 103) is high but does not equal the average for the same 4 years of the leaders for the 9-year period.

The yield of emmer is low. Spring wheat made a good yield of 20 bushels in 1918 but has been low every year since.

WHEAT

Varieties.—Ten varieties of wheat have been tested for periods ranging from 5 to 8 years. Table 17. Gladden is first, Fulhio second, and O-9920, third.

Date of seeding wheat.—The date of seeding wheat has been carried on for 7 years. The date has varied considerably in that time. The average date given in Table 18 represents the average of a 10-day period, in which seedings have been made at intervals during the 7 years. The period centering on October 11 has given the highest average yield, with October 18, second, and October 4 third.

SOYBEANS AND COWPEAS

Of the seven varieties of soybeans tested for the full period of 9 years, Table 19, Midwest yields highest, Hamilton second, and Ebony third. New Era cowpeas have given a very poor yield of seed. Wilson has given a good yield for the 5 years tested. There is a good demand for these late varieties for hay production further north, seed of which may be safely produced in southern Ohio.

TABLE 15.—VARIETIES OF CORN, YIELD PER ACRE AND 9-YEAR* AVERAGE

Variety	1920	1921	Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Lb.*
Leaming	47.88	48.14	51.60	2,053
Clarage (local)	53.31	45.14	54.08	2,469†
White cap	40.46	.....	49.53	2,142‡
Cook's 75	52.02	59.14	56.91	2,411
Reid (Orcutt)	53.97	62.81	58.38	2,742
Ohio 84	40.02	43.33	45.69	1,951
Clarage (northern)	39.74	47.94	49.94	2,081
Darke County Mammoth	56.45	58.57	58.92	2,522
Connor's Prolific	61.36	73.33	61.58	4,442§

*For the annual yields of crops in this and in the following tables, prior to 1920, see Ohio Agr. Exp. Sta. Bul. 344, part 4.
†7-year average. ‡8-year average. §6-year average.

TABLE 16.—VARIETIES OF OATS AND OTHER SPRING CEREALS YIELD PER ACRE AND 9-YEAR AVERAGE

Variety	1920	1921	Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Big Four	82.81	40.15	51.39	2,276
Silver Mine	81.17	34.77	48.56	2,255
Swedish Select	61.09	39.68	42.75	1,837
Ohio 7009	50.38	31.96	40.54	1,666
Miami (Ohio 6203)	65.69	38.67	42.99	1,774
Ohio 6222	65.08	31.33	44.48	2,205
Wideawake	61.64	31.48	42.69	2,498
Albion (Iowa 103)	65.15	.....	53.66	1,550*
Oderbrucker Barley	30.83	8.54	22.07	1,514
Emmer	.....	.....	24.20	2,353†
Spring Wheat	18.33	11.83	12.87	1,165*

*4 years. †5 years.

TABLE 17.—VARIETIES OF WHEAT, YIELD PER ACRE AND 8-YEAR AVERAGE

Variety	1920	1921	Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Nigger	21.70	21.58	24.50	2,659*
Gladden	22.70	20.91	29.61	2,930
Mediterranean	.....	21.08	28.26	3,442†
Red Wave	18.25	21.62	27.57	2,927
Turkey Red	18.49	.....	28.15	3,339*
Portage	22.45	24.75	26.44	2,429
Goens	20.78	18.16	25.98	2,436
Velvet Chaff	18.87	17.58	25.23	2,982
Ohio 9920	21.66	22.42	29.09	2,504†
Fulhio (Ohio 127)	21.25	22.42	29.31	2,730‡

*7 years. †6 years. ‡5 years.

TABLE 18.—DATE OF SEEDING WHEAT, 7-YEAR AVERAGE YIELD PER ACRE, 1915 to 1921

Average date	Bushels
September 6	21.22
September 13	24.11
September 20	24.43
September 27	23.60
October 4	26.16
October 11	27.35
October 18	26.66
October 25	21.77

TABLE 19.—VARIETIES OF SOYBEANS, YIELD PER ACRE AND 9-YEAR AVERAGE

Variety	1920	1921	Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Midwest*	36.96	18.98	21.22	2,700
Ebony	20.67	16.76	18.35	2,360
Elton	17.79	25.09	16.93	2,063
Ohio 9100	26.68	22.98	17.19	1,824
Ohio 9016	26.46	26.92	18.13	2,048
Ohio 7496	.....	.....	14.86	2,493†
Hamilton (Ohio 9035)	35.29	17.48	20.90	2,521
Medium Green	27.90	19.20	15.79	1,997
Wilson	24.34	31.15	23.08	2,305‡
New Era Cowpea	2.67	4.00	3.77	2,398

*Correct name for Mongol, Hollybrook, Roosevelt, and Medium Yellow. †4 years. ‡5 years.

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COUNTY EXPERIMENT FARMS IN OHIO

PART V

THE WASHINGTON COUNTY EXPERIMENT FARM

SEVENTH AND EIGHTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

S. C. HARTMAN, SUPERINTENDENT
C. B. HARVEY, FARM FOREMAN
O. N. RILEY, TRUCK FOREMAN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

General Farm, Fleming

	1921	1922
Original cost: land and buildings	$ 7,762.50	$ 7,762.50
Permanent improvements to March 1, 1920 and 1921	6,808.97	7,223.97
Permanent improvements made during year ended March 1, 1920: New kitchen, $249.86; fencing, $13.40; drainage, $83.50; orchard plantings, $68.24—total	415.00	
March 1, 1921: Cistern, $196.41; drainage, $36.65; lime shed, $93.02—total		326.08
Total permanent investment	$14,986.47	$15,312.55
Operating equipment:		
Livestock:		
March 1, 1920: 4 horses, $410; sheep and lambs, $630—total	$ 1,040.00	
March 1, 1921: 4 horses, $390; 142 sheep, $615—total		$ 1,005.00
Marchinery, tools, and harness	1,302.00	1,195.00
Crops and seeds:		
March 1, 1920: corn, $200; wheat, $150; straw, $20; hay, $150; apples, $130; seed corn, $80—total	730.00	
March 1, 1921: corn, $225; wheat, $25; hay, $90; straw, $50; seed corn, $25; soybean seed, $10—total		425.00
Building material: lumber, $200; sand, $20; paint, $20		240.00
Fertilizer	35.00	10.00
Tile	50.00	30.00
Containers	30.00	55.00
Spray material	30.00	20.00
Sundries	4.00	20.00
Total operating equipment	$ 3,211.00	$ 3,000.00
Total investment	18,207.47	18,312.55

FINANCIAL SUMMARY—Continued

Truck Farm, Marietta

Original cost: land and buildings	$ 8,000.00	$ 8,000.00
Permanent improvements to March 1, 1920 and 1921	1,021.21	1,286.41
Permanent improvements made during year ended March 1, 1920: Furnace, $258; cellar wall, $7.20—total	265.20	
March 1, 1921: Tiling drives, $40.15—total		40.15
Total permanent investment	$ 9,286.41	$ 9,326.56
Operating equipment:		
Livestock: 2 horses	$ 330.00	$ 300.00
Machinery, tools, and harness	478.25	599.00
Crops, feeds, and seeds:		
March 1, 1920: corn, $35; oats, $49; potatoes, $35; straw, $20; hay, $90; seeds, $18—total	247.00	
March 1, 1921: corn, $31; oats, $40; potatoes, $45; straw, $35; hay, $54; seeds, $19—total		224.00
Fertilizer	112.00	85.00
Lumber	25.00	
Containers	67.00	270.00
Plot fixtures	147.00	95.00
Sundries	2.50	7.00
Total operating equipment	$ 1,408.75	$ 1,580.00
Total investment	10,695.16	10,906.56
Total investment, General Farm and Truck Farm	$28,902.63	$29,219.11

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

General Farm, Fleming

	1920	1921
From County Maintenance fund	$ 1,982.46	$ 2,066.21
From Farm sales:		
Livestock and products:		
1920—Horse, $50; sheep, $412.60; wool, $372.65—total	835.25	
1921—Sheep, $176.22; wool, $202.10—total		378.32
Crops:		
1920—Corn, $18.52; rye, $3.75; wheat, $155.98; apples, $1,164.88; peaches, $172.52; pasture, $25—total	1,540.65	
1921—Corn, $30.61; wheat, $536.64; apples, $2,654.01; soys, $7.50—total		3,228.76
Sundries:		
1920—Spray material, 37 cents; barrel, $1.50; cleaning wheat, $23.23; wall board, $1.10; gas royalty, $42.50; wood, $10; refund for hdw., $10.80; refund on fertilizer by O. A. E. S., $31.05; refund for freight by R. R. Co., $298.53; error by Auditor, indraft Jan. 24, 1920, 50 cents—total	419.58	
1921—Barrels, $19.30; horse feed, $62.50; seeds, $1.75; wood, $20; oak tree, $1; implement rent, $17.88; refund on fertilizer, $23.75—total		146.18
Total receipts	$ 4,777.94	$ 5,819.47

Truck Farm, Marietta

From truck sales:		
1920—Cabbage, $2,721.51; cucumbers, $587.36; sweet corn, $351.10; tomatoes, $472.71; potatoes, $48.88; egg plant, $58; popcorn, $14.50; seeds and plants, $39—total	$ 4,293.06	
1921—Cabbage, $1,344.59; cucumbers, $318.94; tomatoes, $402.66; sweet corn, $359.16; potatoes, $13.50; popcorn, $9; egg plant, $71.44—total		$ 2,519.29
Sundries:		
1920—Refund on fertilizer, $5.41; labor on public roads, $13.70—total	19.11	
1921—Refund on fertilizer, $14; R. R. claims, $6.64; insurance, $4; refund on crates, $21.43; putty, $10.50; labor on public roads, $22.90; dividends on 1920 sales, $20.96—total		100.43
Total receipts	$ 4,312.17	$ 2,619.72
Total receipts for the two farms	9,090.11	8,439.19
Balance brought forward	1,085.49	1,455.89
	$10,175.60	$ 9,895.08

RECEIPTS AND EXPENDITURES—Continued

Cr.

By Expenditures

General Farm, Fleming

	1920	1921
For labor	$ 2,505.64	$ 2,551.35
For permanent improvements:		
1920—Building material, $249.86; fence, $13.40; drainage, $83.50; orchard plantings, $68.24—total	415.00	
1921—Building material, $70.12; cistern and pump, $77.49—total		147.61
For machinery and tools	246.96	364.13
For livestock:		
1920—Interest on sheep, $2.71	2.71	
1921—Sheep, $48.50		48.50
For current expenses*	2,451.49	1,088.11
Total expenditures	$ 5,621.80	$ 4,199.70

Truck Farm, Marietta

For labor	$ 2,067.03	$ 1,937.90
For permanent improvements:		
1920—Building material, $258; concrete work, $7.20—total	265.20	
1921—Drainage, $17.15—total		17.15
For machinery and tools	6.10	211.75
For current expenses*	759.58	1,369.89
Total expenditures	$ 3,097.91	$ 3,536.69
Total expenditures for the two farms	8,719.71	7,736.39
Balance forward March 1	1,455.89	2,158.69
	$10,175.60	$ 9,895.08

*ITEMIZED CURRENT EXPENSES

General Farm, Fleming

	1920	1921		1920	1921
Seeds	$255.85	$ 53.30	B'ldg. maintenance	$ 92.12	$ 32.42
Fertilizer	439.60	224.77	Water supply main	2.34	.93
Spray material	101.75	175.16	Implement main.	87.70	97.37
Containers	922.37	126 88	Engine maintenance	52.55	18.04
Binder twine	15.61	3.97	Transportation	61.17	82.55
Machinery hire	65.52	69.13	Communication	36.22	32.16
Plot fixtures	.50		Publicity	64.70	23.36
Feed	169.58	58.00	Office supplies	2.60	.83
Horse shoeing	9.80	9 35	Miscellaneous hdw.	19.24	5.42
Livestock equipment	32.42	7.44	Gasoline and oil		35.02
Veterinary	7.85	9.41	Apple storage		5.05
Livestock incidentals	12.00	17.35			
			Total	$2,451.49	$1,088.11

Truck Farm, Marietta

Seeds	$119.35	$ 65.16	Water supply main	$ 6.40	$ 47.10
Fertilizer	134.05	143.16	Implement main.	30.42	5.85
Spray material	40.50	30.10	Engine maintenance	5.83	.80
Twine	.95	5.00	Communication	43.90	50.92
Containers	15.80	699.72	Publicity	17.53	12.75
Greenhouse mainten'ce	45.36	14.95	Office supplies	1.00	
Feed	214.84	163.00	Miscellaneous hdw.	1.96	2.39
Horse shoeing	26 00	36.05	Error on indraft	.50	
Livestock equipment	3.00	7 10	Fence maintenance		1.59
Livestock incidentals	2.35	3.50	Transportation		35.06
Veterinary	5.00	8.30	Gasoline and oil	20.40	16.14
B'ldg. maintenance	24.44	21.25			
			Total	$ 759.58	$1,369.89

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of general farm in acres	1920	1921	Area of truck farm in acres	1920	1921
Farmstead	1.25	1.25	Farmstead	0.70	0.68
Cultivated	66.82	68.90	Cultivated	7.90	7.92
Permanent pasture	40.85	38.62	Public road	.25	.25
Orchard	20.00	20 00	Farm roads	.95	.95
Woodlot	32.35	31.00			
Public roads	7.50	7.50			
Farm roads	3.75	3.75			
Forestry		1.50			
Totals	172.52	172.52		9.8	9.8

Plot Work on General Farm

	1920			1921		
	Number of plots	Acres	Yield per acre	Number of plots	Acres	Yield per acre
Corn	30	3	47.4 bu.	30	3.00	50.3 bu.
Wheat	30	3	16.7 bu.	30	3.00	18.6 bu.
Hay (soybean)	30	3	2.0 tons	30	3.81	1.5 tons
Hay (clover)	30	3	.9 ton	30	3.81	1.0 ton
Totals	110	12		120	13.62	

Field Work on General Farm

Corn		11.10	59.6 bu.		13.45	64.6 bu.
Wheat		10.00	24.4 bu.		9.76	18.6 bu.
Rye		1.45	18.5 bu.		2.90	16.6 bu.
Hay (pea and oat)		1.25	1.1 tons		.80	.5 ton
Hay (soybean)		8.60	1.2 tons		5.66	2.1 tons
Hay (oats)		4.00	1.7 tons			
Hay (alfalfa)		1.17	1.6 tons		3.50	forage
Hay (clover)		18.00	.8 ton		8.46	2.4 tons
Rape (forage)		4.00			3.50	
Pasture (temporary)		3.00			1.50	
Rye (pasture)		3.00			2.25	
Clover (forage)					3.25	
Truck perquisite		.25			.25	
Totals		65.82			55.28	
Less (double cropped)		11.00				
		54.82				
Apple orchard		17	33.3 bbl.		20	6.2 bbl.
Peach orchard		3	43.1 bu.			

Plot Work on Truck Farm

Cabbage	32	.8	7.7 tons	44	1.33	12.5 tons
Cucumbers	32	.8	15.4 tons	32	.80	10.6 tons
Sweet corn	32	.8	4.5 tons	32	.80	4.3 tons
Tomatoes	32	.8	4.1 tons	32	.80	3.3 tons
Totals	128	3.2		140	3.73	

CROP AND LABOR STATISTICS, 1920 AND 1921—Continued

Field Work on Truck Farm

	1920		1921	
	Acres	Yield per acre	Acres	Yield per acre
Cabbage	2.46	11.4 tons	1.23	13.5 tons
Sweet corn	1.09	163.3 hamp.	1.54	163.0 hamp.
Tomatoes	.63	.9 ton	.72	4.5 tons
Egg plant	.06	666.0 hamp.	.34	138.0 hamp.
Pop corn	.15	90.5 bu.	.....	.....
Potatoes	.25	320.0 bu.	.38	131.6 bu.
Garden and beetle test	.31	.....	.12	.....
Cucumbers	.....	.....	.24	10.4 tons
Totals	4.95	.....	4.57	.....
Less potatoes after cabbage	.25	.....	.38	.....
	4.70	.....	4.19	.....

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

General Farm

		Corn	Wheat	Soybean hay	Clover hay
		Bu.	*Bu.*	*Tons*	*Tons*
Highest	1920	59.8	29.3	3.0	0.9
	1921	66.7	26.6	2.9	1.3
Lowest	1920	26.8	1.6	1.0	.2
	1921	18.4	6.9	.7	.3

		Tomatoes	Sweet corn	Cucumbers	Cabbage
		Tons	*Tons*	*Tons*	*Tons*
Highest	1920	6.7	5.6	22.7	10.8
	1921	4.2	5.4	19.9	14.2
Lowest	1920	1.6	2.9	6.9	4.2
	1921	1.5	1.6	3.0	5.8

LABOR

	General Farm		Truck Farm	
	1920	1921	1920	1921
Number of work horses	4	4	2	2
Crop-acres per work horse	19.4	17.2	4.07	4.1
Man-hours per year beginning March 1	5,824	9,058	5,260	5,167
Horse-hours per year beginning March 1	4,781	4,690	2,206	2,136

REPORT OF WORK FOR THE YEARS 1920 AND 1921

S. C. HARTMAN

An attempt has been made during the two years to meet after-war conditions. Production costs of farm crops for the two years were considerably higher than market prices. Not only that, but any possible margin over cost of production, if used for repairs or improvements, was expended at a decided disadvantage when compared with pre-war costs.

The relative financial condition of agricultural interests of the county for the first of the two years as compared with previous years is shown in the report of the farm survey of Palmer Township, made each year for the last ten years by H. W. Hawthorne of the United States Department of Agriculture. In Table 1, compiled from these reports, the first post-war year, 1920, is compared with the four war years, 1916-1919, and the four pre-war years, 1912-1915.

TABLE 1.—AVERAGE CAPITAL, RECEIPTS, EXPENSES, AND INCOME FROM 25 FARMS, PALMER TOWNSHIP, WASHINGTON COUNTY

	4 years 1912-1915	4 years 1916-1919	1 year 1920
Capital	$6,313	$7,277	$8,279
Receipts	879	1,521	1,182
Expenses	410	643	738
Farm income	469	878	444
Labor income	154	514	30
Purchasing power farm income	469	496	184
Purchasing power labor income	154	290	13
Index price, all commodities	100	177	243

For the pre-war period the average farm income amounted to $469; for the war years, $878; and for the year 1920, $444. But when these incomes are measured by what they would buy, using the pre-war year as a basis, they become $469, $497, and $184, respectively. The income for the year 1920 would buy only 2/5 as much as that for the average pre-war year.

PERMANENT IMPROVEMENTS

A furnace was placed in the residence on the Truck farm in 1920 at a cost of $258. A cement cistern is being built at the Fleming farm, on the hillside above the barn, to be supplied with water from the barn roof. This will permit the water to be run by gravity from the cistern into the barn for the stock, or in case of heavy rainfall, pumped into the cistern on the hill.

THE ORCHARD

The two years have further emphasized the importance of the orchard. In 1920, 700 barrels of apples were harvested, almost 500 barrels coming from the hill orchard, a few barrels from the young variety orchard, and about 200 barrels from the old orchard near the house. In spite of the large crop in 1920, which was pretty general over the country, well-grown, well-packed apples brought a profitable price.

The freeze in April, 1921, when the trees were in full bloom, killed much of the fruit and gave the impression of a total failure. However, apple sales for the year amounted to more than $500. The price of fancy apples in 1920 was $2.85 per barrel and in 1921 $6.50 per barrel, above the cost of the barrel.

The first crop was harvested from the variety peach orchard in 1920. There were 100 bushels of forty-one varieties of peaches, but no crop the following year.

A Ballou grader was added to the orchard equipment in 1921, after a trial in the season of 1920. By equipping the spraying outfit with larger pump cylinders and a heavier engine, the cost of spraying was considerably reduced.

THE PASTURE

Following a definite plan in fertilizing the pasture, one-half the land received either acid phosphate or limestone each year. Thus every four years each acre receives 400 pounds of acid phosphate and one ton of limestone. Where convenient, a dressing of manure or litter is applied to the thin spots. To determine the most practical method of improving permanent pastures, fourteen 1-40th-acre test plots were laid off in 1920, fertilized in various ways, reseeded, and cut at frequent intervals with a lawn mower. Even the unfertilized plots showed improvements from the seeding and frequent mowing.

The plot receiving three tons of phosphated manure per acre showed the greatest improvement. Acid phosphate with nitrate also showed immediate results. A mulch of two tons per acre of wheat chaff resulted in considerable improvement.

Forage crops have helped out materially with the summer feed. The rotation of rape, rye, and clover mixture has been continued. The 1920 crop of rape was not satisfactory because of a light stand. Clover was a poor stand in 1921 because of pasturing too soon after seeding; but by reseeding to sweet clover considerable pasture was secured. The lambs ate the sweet clover in the

clover mixture as readily as the alfalfa or medium clover. Rye in the rotation yielded well. In the fall of 1921 vetch was seeded with the rye. The mixture was pastured lightly that fall and now looks promising for spring forage.

Alfalfa was seeded in the four-acre forage plot with oats in 1920. The oats were cut for hay and a good stand of alfalfa secured. The alfalfa still continues good, though bluegrass is threatening its right to the ground. Alfalfa makes excellent pasture but will continue longer when cut for hay than when pastured. It is the intention to keep this forage field in alfalfa.

SHEEP

The sheep kept on the Washington County Experiment Farm are largely purebred and grade Merinos of the C and light B types. The exception is a small flock of crossbred ewes sired by a mutton ram and out of Merino ewes. In 1917 increased sheep production was urged to meet war demands. Since land and equipment were available to warrant keeping a larger flock, the crossbred ewe lambs were retained for breeding purposes until the fine wool flock could be increased to the desired size. During the last few years market conditions have been such that the crossbred ewes could not be disposed of to advantage, consequently they are still on the farm.

For the past three years these crossbred ewes have been bred to a Southdown ram for January and February lambs, which were sold in June of the same year as early lambs. The Merino ewes were bred to a Merino ram to lamb in the spring. The desirable ewe lambs from this mating were retained for the breeding flock to replace the ewes that died or were disposed of on account of their age or other reasons. The remaining lambs were fed throughout the winter and sold the following spring after shearing at approximately one year of age. Where one is equipped with feed and shelter, the practice of keeping the Merino lambs and selling them in the spring after shearing has been found more profitable than crossbred lambs handled in the same way.

The yearly returns from these two systems of production during 1920, 1921, and 1922 were slightly in favor of the winter lambs, due in part to the higher proportion of lambs sold to lambs born. Another factor was the depressed market conditions when the clipped lambs were sold. The results indicate that there is a possible place for winter lamb production on Washington County farms.

In the record of the flock for 1921, we have the most discouraging of the post-war deflation years. The inventory at the

beginning of the year was higher than the sales made during the following months would justify, and at the close of the year the price of lambs and wool had not advanced to any great extent. Consequently the very satisfactory sales made the following months are not reflected in the inventory. With much of the corn fed valued at $1.00 per bushel—the 1921 price of corn at the local market was considerably above the average for the State—with wool selling at less than 25 cents per pound, and the lambs which were fed to sell in the spring of 1921 after shearing returning but 3 cents a pound, a loss on the flock was inevitable. Better prices for lambs and wool and lower feed costs promise a more profitable season to follow.

FINANCIAL SUMMARY OF SHEEP WORK FOR 1921

DEBITS		CREDITS	
First Inventory:		Second Inventory:	
Equipment	$ 327.00	Equipment	$ 321.00
Stock	630.00	Stock	630.00
Total	$ 957.00	Total	$ 951.00
Expenses:		Receipts:	
Sheep bought	$ 58.45	Sheep sold	$ 60 68
Feed consumed	539.76	Lambs sold	119 49
Man-hours, 967.4 at 31c	299.89	Wool sold	222 10
Horse-hours 5 5 at 14c	.77	Manure	62.10
Supplies bought	4.67	Experimental labor	100.00
		To balance (loss)	345.17
Totals	$1,860.54		$1,860.54

THE GARDENS

The net sales per acre were larger in 1920 than in either of the two previous years. This was true largely because the truck crops were marketed before the fall in prices which affected farm crops. In 1921 the sales were materially lower, but still sufficiently high to contrast strongly with the prices of ordinary farm crops.

Cabbage continues to have first place in acreage. It also returns the largest net sales per acre, with the single exception of egg plant in 1920, the acreage of which was too small for a fair comparison. The yield of cabbage was a material increase over that of the previous years. Since the future of cabbage in this district is threatened by cabbage yellows, efforts are being made to secure resistant varieties, sufficiently early to answer the purpose.

The high yield of cucumbers in 1919 was exceeded in 1920 by 80 hampers per acre. The higher yield of this crop for the last few years is largely due to the arsenate-of-lime and land-plaster treatment originated by Station entomologists.

The cost of containers was higher in 1920 and 1921 than in 1918 or 1919, constituting a larger percentage of net sales. In fact, in 1921 one-sixth of the income from three of the five crops was spent for packages.

Copenhagen Market and Early Jersey Wakefield cabbage have been grown each year. The Copenhagen Market returned $150 per acre each year more than the Wakefield, above labor and material cost of production. This fully justifies the decrease in the relative amount of Wakefield cabbage grown.

TABLE 2.—RETURNS AND SELLING COSTS PER ACRE OF TRUCK CROPS

Drops	Acres	Container* yield per acre	Net price per package	Net return† per acre	Cost per acre	
					Containers‡	Selling
1920						
Cabbage	3.26	219.0	$3.81	$834.39	$80.59	$165.69
Corn	1.89	160.3	1.95	191.55	22.92	62.88
Cucumbers	1.17	474.8	1.11	527.03	74.56	172.34
Tomatoes	1.43	328.7	.96	315.55	25.78	76.97
1921						
Cabbage	2.56	278.1	1.89	525.60	89.84	153.94
Corn	2.34	110.3	1.28	141.18	23.16	49.00
Cucumbers	1.04	359.0	1.12	402.08	70.06	136.79
Tomatoes	1.51	334.4	.79	264.17	30.10	69.16

*Containers used and net weights are as follows: Cabbage in crates, 100 lb.; corn in hampers, 55 lb.; cucumbers in hampers, 55 lb.; tomatoes in baskets, 20 lb.
†Net returns are gross selling returns less selling cost, or farm gross return.
‡Cost of material only.

Mention has been made of the high cost of growing cover crops. It has been the practice to plow down the crop of cowpeas for the improvement of the soil. At the same time high prices for hay have been paid. The question naturally arose as to whether it would not be more profitable to cut the cowpeas for hay and return the manure to the soil. To throw some light on the question the following series of plots were started in duplicate in 1921:

Plot 1. Cowpeas cut for hay, followed by rye which is plowed down the following spring.
Plot 2. Cowpeas disked in and followed by rye.
Plot 3. No cover crop, weeds are allowed to grow.
Plot 4. Crimson clover.
Plot 5. Hairy vetch.
Plot 6. Oats, Canadian peas, and vetch.

The cover crop mentioned for the different plots is sown after the harvesting of the truck crop. From observation of the first year's work, hairy vetch might well fill a much larger place as a cover crop in this district.

FARM GATHERINGS

The Farm Bureau Picnic and Experiment Farm Field Day were held as usual on the first Thursday of August, each year.

The attendance was estimated at 3,000. A meeting of truck farmers is held at the truck farm during the last week of June each year. An apple demonstration was held in 1920, and a wool grading demonstration was held in the fall of 1921. Several picnic groups and high school classes met at the farm. Such groups, as well as individual visitors, are always welcome at the farms.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

I. EXPERIMENTS ON FIELD CROPS

Because of the limited area of land suited to plot experiments, the study on this farm of the use of fertilizers and manures on field crops is limited to a single experiment on crops grown in the 4-year rotation of corn, soybeans, wheat, and clover, and since the livestock on this farm will be chiefly sheep a special study of sheep manure is planned.

TABLE 3.—Plan of fertilizing, Washington County Experiment Farm

Pounds of fertilizing materials per acre for each crop

Plot	On corn				On soybeans			On wheat		
	Acid phosphate	Muriate potash	Nitrate soda	Ground limestone	Acid phosphate	Muriate potash	Nitrate soda	Acid phosphate	Muriate potash	Nitrate soda
1										
3	200				100			200		
3	200	50			100	20		200	20	
4										
5	200	50	50		100	20	30	200	20	80
6	200	50	50	1 ton	100	20	30	200	20	80
7										
8	125	90	200					125	90	200
9	375	90	300					375	90	300
10										
11										
12	Sheep manure, 2 T.							Sheep manure, 2 T.		
13	Sheep manure, 2 T.; acid phos., 250 lb.							Sheep manure, 2 T.; acid phos., 250 lb.		
14										
15	Sheep manure, 2 T.; acid phos., 400 lb.							Sheep manure, 2 T.; acid phos., 400 lb.		
16	Sheep manure, 4 T.; acid phos., 400 lb.							Acid phosphate, 400 lb.		
17										
18	Sheep manure, 4 T.; acid phos., 400 lb.			1 ton				Acid phosphate, 400 lb.		
19	Horse manure, 4 T.; acid phos., 400 lb.							Horse manure, 4 T.; acid phos., 400 lb.		
20										

Table 3 shows the distribution of fertilizers and manure on the different crops, and the results to 1921 are given in Tables 4 to 7. Plots 2, 3, 5, and 6 in this experiment receive the same treatment given to the correspondingly numbered plots in similar experiments

on the other county experiment farms, thus giving opportunity for comparison of this system of crop rotation and treatment under different conditions of soil and climate.

The complete fertilizer, as used on Plots 5 and 6, contains approximately 4 percent ammonia, 11 percent phosphoric acid and 6 percent potash, as actually made up and used. No commercial fertilizer, however, is made up exclusively of such high grade materials as 16-percent acid phosphate, nitrate of soda and muriate of potash. If these materials are used at all they are diluted with some "filler", which may as well be the earth of the field on which they are to be used as anything else. The addition of 250 pounds of dirt to these mixtures would give 1,000 pounds of a 3-8-4½ formula, which would contain precisely the same quantities of fertilizing constituents as the 750 pounds actually used.

On plot 8 the acid phosphate is reduced to one-half the standard application, while the nitrate of soda and muriate of potash are increased. This gives a fertilizer carrying approximately the same quantity of phosphoric acid as the 4 tons of sheep manure used on Plot 12 but still with less ammonia and potash. On Plot 9 a further increase of nitrate of soda is made and the quantity of phosphoric acid is raised to 120 pounds, to compare with the 4 tons of manure reinforced with acid phosphate used on Plot 13. On Plots 15 to 19 the manure is reinforced with still larger quantities of acid phosphate, for the purpose of bringing the ammonia-phosphoric acid-potash ratio to a point more nearly in line with those familiar in commercial fertilizers, although the difference is still large. Estimating manure at 75 percent water, the 4 tons of manure would contain one ton of dry substance which, reinforced with 800 pounds of acid phosphate, would give a 5-6-3½ formula on these plots.

In Table 3 the results are reduced to the common denominator of dollars and cents by computing corn at half a dollar a bushel, oats at one-third of a dollar, wheat at one dollar, soybean hay at fifteen dollars and clover hay at ten dollars a ton. In this table also the cost of 16 percent acid phosphate is computed at $20.00 a ton, spread on the field, equivalent to 6¼ cents a pound for phosphoric acid; that of muriate of potash at $60.00 a ton, equivalent to 6 cents a pound for actual potash; that of nitrate of soda at $60.00 a ton, equivalent to about 20 cents a pound for nitrogen or 16 cents for "ammonia", and that of ground limestone at $4.00 a ton. These valuations do not correspond to exact prices at any time or place, but they serve the purpose of comparison.

The analyses of sheep manure, made by Ames and his co-workers of the Ohio Experiment Station, indicate an average composition of approximately 35 pounds of ammonia, 10 pounds of phosphoric acid, and 24 pounds of potash per ton of manure; and those of horse manure show about 17 pounds of ammonia, 5 pounds of phosphoric acid, and 15 pounds of potash to the ton. If these quantities of fertilizing constituents could be retained in the manure until it reaches the field and were to prove as effective there as those in nitrate of soda, acid phosphate, and muriate of potash, a ton of sheep manure would have a value of $7.70, as compared with the estimated cost of the chemicals named. The investigations of Ames and his co-workers, however, have shown that not only is there a large avoidable loss of all the essential constituents of manure when it is exposed to the weather; but there is also a material loss of nitrogen whenever manure is handled, which cannot be entirely avoided. Moreover, the field experiments of this Station have shown that such organic carriers of nitrogen as dried blood, tankage, and linseed oilmeal are inferior in effectiveness to nitrate of soda. For these reasons the chemical valuation of manure in Table 7 is computed on the basis of 10 cents a pound for ammonia, 5 cents for phosphoric acid and a fraction over 6 cents for potash, or a total of $5.00 per ton of manure. It will be seen that this valuation is still rather higher than the outcome justifies.

The tables show that acid phosphate has increased the yield of every crop, and the total estimated value of this increase amounts to more than twice the cost of the phosphate.

The addition of muriate of potash to acid phosphate has not yet shown any further increase in the general yield. It is not probable that the potash has reduced the yield and that of Plot 3 is taken as the actual increase from the acid phosphate. The further addition of nitrate of soda has been followed by an increase in yield, found chiefly in the wheat, amounting to a total value over that given by acid phosphate (on Plot 3) of $5.75, or 19 cents per pound of ammonia. As the cost of a pound of ammonia, however, is around 16 cents in nitrate of soda, and would be 25 cents or more in a factory-mixed fertilizer, the increase has not justified the purchase of ammonia in factory-mixed fertilizers.

The addition of a ton of limestone to this complete fertilizer brings the total increase up to about double that produced by acid phosphate alone—the benefit from liming being shown chiefly by the corn and hay crops—and leaves a larger net balance than that produced by acid phosphate alone, notwithstanding the fact that

the cost of treatment is multiplied by three. In the experiments at Wooster it has been found that one of the effects of liming is to increase the action of potash, and that may be one of the explanations of the outcome in this test.

When limestone has been used on manured land (Plot 18) the increase over land similarly manured but not limed (Plot 16) has been practically the same as that found on fertilized land. If the cost should be greater than $4.00 a ton the margin would of course be smaller. Other experiments have shown that the effect of liming is not exhausted during a 4-year period.

When the lime is omitted and the relative composition of the fertilizer for Plot 8 is made to approach more nearly that of manure by increasing the ammonia and potash and reducing the phosphoric acid, the yield, while falling below that of the limed land, is considerably larger than that attained before lime was added, the increase being found chiefly in the corn and wheat. If we assume that this increase has all been due to the larger dose of nitrate of soda, an assumption that seems logical in view of the reduction of phophoric acid, we shall have a further increase of $7.06, or 15 cents a pound for the additional ammonia.

This rate of increase is not maintained when the ammonia is increased to 114 pounds, on Plot 9, together with an increase in the phosphoric acid, the increase over Plot 8 being only $4.07, or about 11 cents a pound for the additional ammonia if it were all credited to that constituent of the fertilizer. This outcome, however, is in harmony with the well known law of diminishing returns, under which the gain per unit of fertilizer or feeding stuff diminishes as the limit of growth of plant or animal is approached.

Plots 12 and 13 are estimated to have received the same quantities of phosphoric acid, a little more potash, and considerably more ammonia than Plots 8 and 9, respectively, had there been no loss between stable and field and had the constituents of the manure been as effective, pound for pound, as those of the chemicals. Even after deducting about one-third from the estimated value of the manure for such losses, however, the increase on Plot 12 is still nearly 20 percent lower than that on Plot 8, and that on Plot 13 is more than 20 percent lower than that on Plot 9.

The long continued experiments at Wooster and Strongsville indicate that a part of the difference in effect between manure and chemicals lies in the fact that manure is slower than the chemicals in getting into action; the effect of manure in these experiments being 30 percent lower than that of an equivalent dressing of chem-

icals during the first 5 years, but the two dressings were practically equal during the fourth 5 years, allowance being made for the losses in manure.

As this Washington County experiment stands it is plain that if the cost of manure equals that of equivalent quantities of ammonia, phosphoric acid, and potash in nitrate of soda, acid phosphate, and muriate of potash, the preference should be given to the chemicals; but when the only cost of manure is the moving it from the stable to the field the problem is altogether different, as shown by the last two columns of Table 7, in which the cost of manure is computed at only 50 cents a ton, to cover the cost of hauling out and spreading. Computed on this basis the manuring leaves a much larger balance than any other treatment.

It will be observed that Plot 16 gives a lower yield than any other manured plot. On this plot the manure is all given to the corn crop, whereas on all the rest, except No. 18, it is equally divided between the corn and wheat. The outcome is in harmony with other experiments in showing that as far as practicable every grain crop in the rotation should receive a share of the manure or fertilizer, and also with the experience that larger applications are less effective per unit than smaller ones. Thus at Wooster the 25-year average effect of a 16-ton application of yard manure every 5 years has been $2.70 per ton of manure, whereas the increase from an 8-ton dressing has been $3.17 per ton. The lower balance on Plot 16 than on Plot 12, as shown in the last column of Table 7, is due to the cost of the additional phosphate, not to that of the lime, as shown by comparison of Plots 12 and 15.

PRACTICAL APPLICATIONS

These experiments show that properly handled farm manure is the cheapest fertilizer for this land, if its cost be merely the labor of moving it from the stable to the field.

In the absence of manure acid phosphate has produced a very profitable increase of crop, but the supplementing of sheep manure with acid phosphate has not produced sufficient additional increase to justify the cost of the phosphate.

Potash, given in the muriate, its most effective carrier, has not increased the yield.

Nitrogen, in nitrate of soda, has increased the yield, but not sufficiently to justify its cost.

Since the cost of ammonia and potash in factory-mixed fertilizers is always greater than their cost in nitrate of soda and muriate of potash, the purchase of such fertilizers cannot be recommended for this soil.

Ground limestone has produced a marked increase in yield, whether used with chemicals or with manure.

Taking the different applications as actually made in this test the total gains, not deducting cost of materials, have been:

From 4 tons untreated sheep manure	$21.45	
From 500 pounds acid phosphate	12.74	(Plot 3)
From 1 ton ground limestone	11.09	
From 160 pounds nitrate of soda	5.75	

In a feeding experiment made by the Ohio Experiment Station the production of manure by sheep was at the rate of 33 pounds per day, including bedding, for 1,000 pounds live-weight of animals, At this rate a lot of sheep weighing 1,000 pounds would produce a ton of manure in about 60 days.

The soybeans in this test have been mown for hay, and Table 5 shows that the yield of soybean hay has been more than twice as great on the unfertilized land and 40 to 70 percent greater on the manured or fertilized land than that of clover. Soybean hay, if cut when the pods are full size but before the beans are fully formed, and carefully cured, is worth much more than clover hay.

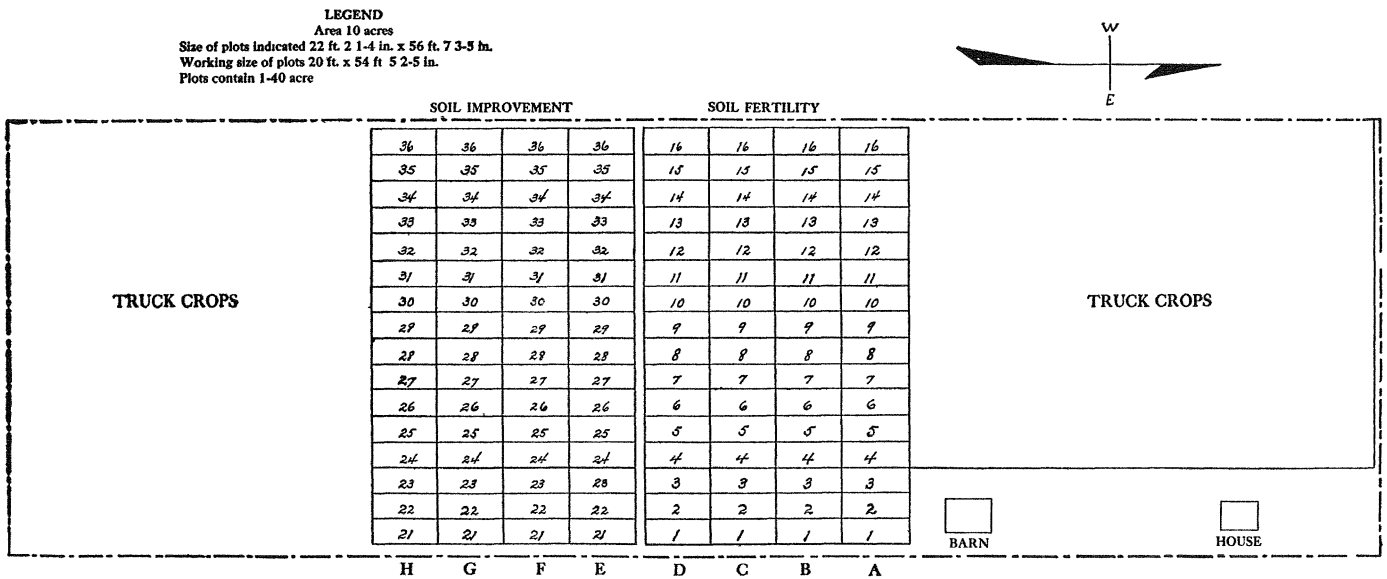
At the Miami County Experiment Farm the beans have constituted 40 percent of the total weight of the soybean crop. If we rate the beans at $1.20 a bushel in the straw, and the straw at $4.00 a ton, or at the same rate as corn stover, the 40 pounds of beans and 60 pounds of straw in 100 pounds of total produce would have a value of 92 cents, or $18.40 a ton, and the average yield on the unfertilized land in these experiments would be worth $27.00 an acre, as against $25.00 for the average yield of corn and $11.00 for the average yield of wheat. On the fertilized and manured land the average values would be $31.50 for soybeans, $32.00 for corn and $20.86 for wheat.

INCREASING THE YIELD OF TRUCK CROPS

The experiments on increasing the yield of truck crops occupy two parallel series of plots containing 1-40 acre each, arranged as shown in the diagram on page 457, and located on the terrace plain of the Muskingum River, about 4 miles north of Marietta.

Series A receives a basic treatment of ground limestone, spread over all the land every second season at the rate of 2 tons per acre, and cover crops consisting of cowpeas after sweet corn, cabbage, and tomatoes and of rye after cucumbers.

Series B receives as basic treatment the same cover crops as Series A, except that Plot 21 has received a straw mulch, which has reduced the yields.



Plan of Truck Crops Division, Washington County Experiment Farm

Washington County Experiment Farm, Truck Crops Division; Plan of experiments in the use of fertilizers, manures, and cover crops. Fertilizers and manures per acre. Plots 1-40 acre

SERIES A SOIL FERTILITY PLOTS		SERIES B SOIL IMPROVEMENT PLOTS	
1	Unfertilized	21	Unfertilized. Mulched with straw
2	Shed manure, 16 tons Acid phosphate, 400 lb.	22	Unfertilized
3	Shed manure, 16 tons	23	Manure, 16 tons Acid phosphate, 400 lb. Nitrate soda, 160 lb.; mur. potash, 50 lb.
4	Unfertilized	24	Manure, 16 tons
5	City manure, 16 tons	15	Manure, 16 tons Ground limestone, 1 ton
6	Acid phosphate, 800 lb. Nitrate soda, 320 lb. Muriate potash, 100 lb.	26	Manure, 16 tons; ground limestone, 1 ton Acid phosphate, 400 lb. Nitrate soda, 160 lb.
7	Unfertilized	27	Manure, 16 tons
8	Acid phosphate, 400 lb. Nitrate soda, 160 lb. Muriate potash, 50 lb.	28	Manure, 16 tons Acid phosphate, 400 lb. Ground limestone, 1 ton
9	Acid phosphate, 400 lb. Nitrate soda, 160 lb.	29	Unfertilized
10	Unfertilized	30	Acid phosphate, 400 lb. Nitrate soda, 160 lb. Muriate potash, 50 lb.
11	Acid phosphate, 400 lb.	31	Acid phosphate, 400 lb. Nit. soda, 160 lb.; mur. potash, 50 lb. Ground limestone, 1 ton
12	Nitrate soda, 80 lb. Sulphate ammonia, 65 lb.	32	Unfertilized
13	Unfertilized	33	Ground limestone, 1 ton
14	Nitrate 160 lb. (In two applications)	34	Acid phosphate, 400 lb. Nitrate soda, 160 lb. Ground limestone, 1 ton
15	Nitrate soda, 160 lb. (In one application)	35	Unfertilized
16	Uufertilized	36	Acid phosphate, 400 lb. Ground limestone, 1 ton

Plots 1 to 16 are cross-dressed every second season with finely-ground raw limestone, 2 tons per acre, spread over fertilized and unfertilized land alike. They have also received a cover crop of cowpeas after sweet corn, cabbage, and tomatoes, and of rye after cucumbers.

Plots 22 to 28, inclusive, receive a cover crop of rye after each crop and Plots 29 to 36 receive a cover crop of cowpeas after each crop except cucumbers, which are followed by a rye cover crop.

The fertilizing materials, other than the limestone on Series A, are repeated on every crop, in the quantities shown in the plan given on page 458.

The yields obtained in this experiment for 1920 and 1921, and for the average of the 7 years since the experiment was begun, are given in Table 8 to 10. In Table 10 the results of the entire experiment are combined by computing sweet corn at 2 cents a pound, cucumbers at 1½ cent, cabbage at 2 cents, and tomatoes at 3½ cents; and estimating the cost of ground limestone at $5.00 a ton, manure at $2.00 a ton, 16 percent acid phosphate at 1 cent a pound, and nitrate of soda and muriate of potash each at 3 cents a pound, all spread on the land.

These valuations of produce are of course estimates only. They are based upon the average for several years of prices received, and are intended to be low enough to show approximately the value of the produce at the farm, less cost of marketing.

The cost of manure is placed at $2.00 a ton, as being probably its minimum average cost where it must be purchased and then hauled for several miles.

Table 10 shows that, on the basis of the valuations here employed, sweet corn has been a relatively unprofitable crop. Not only is the total value of the crop comparatively low, but it has given a much lower return for treatment than any of the other crops, not only in total amount but in percentage of untreated yield. In several cases the increase from sweet corn has failed to cover the cost of treatment; this has not occurred with any other crop except tomatoes, which have not paid for nitrate of soda when used alone, and which show a smaller rate of increase than the other crops when nitrate is added to acid phosphate (compare plots 11 with 9, and 36 with 34).

EFFECT OF NITROGEN AND PHOSPHORUS

On Plot 14 the nitrate application has been divided, giving half the total quantity at time of planting and half later, with the result of a reduction of increase in every crop as compared with applying the whole amount at time of planting, as is done on Plot 15. On Plot 12 half the nitrogen ration is given in sulphate of ammonia, a slower-acting carrier of nitrogen than nitrate of soda, with again a reduction in increase, except in case of tomatoes. The lesson appears to be that, for these crops on this soil, if no more than 25 pounds of nitrogen (the quantity carried in 160 pounds of nitrate of soda) is given, it should be in one application and at the time of

planting. That more nitrogen than this amount might be used with profit is indicated by the outcome on Plot 6, on which the entire dressing of chemical fertilizers has been doubled, as compared with Plot 8. Although the total increase has not been doubled, the balance left, over the cost of the fertilizer, has been materially increased.

The relative effect of nitrate of soda and acid phosphate used separately and combined is set out below in a comparison of the increase on Plots 15, 11, and 9:

COMPARATIVE EFFECT OF NITRATE OF SODA AND ACID PHOSPHATE

Plot	Fertilizer	Value of increase				
		Sweet corn	Cucumbers	Cabbage	Tomatoes	Average
15	Nitrate soda	$ 6	$27	$39	$ 2	$18
11	Acid phosphate	13	27	38	56	33
9	Nitrate soda and acid phosphate	18	51	69	75	53

Because of the greater cost of nitrate of soda, as used in this experiment, the balance left after paying the cost of the fertilizer is greater in every case from the acid phosphate; yet it has been much more profitable to combine the two than to use either alone.

EFFECT OF POTASSIUM

Muriate of potash, in the quantity used, apparently has had but little effect, as shown by comparing the increases on plots 8 and 9, and 31 and 34, which are set out below:

EFFECT OF MURIATE OF POTASH

Plot	Fertilizer: Acid phosphate and nitrate of soda	Value of increase				
		Sweet corn	Cucumbers	Cabbage	Tomatoes	Average
8	With muriate potash	$13	$45	$ 73	$ 62	$48
9	Without potash	18	51	69	75	53
31	With muriate potash	29	87	157	79	88
34	Without potash	28	57	153	104	85

In comparing these pairs of plots it must be remembered that on Plots 8 and 9 the increase given is that in excess of the yields produced by the basic dressing of limestone, whereas on Plots 31 and 34 the increase due to the limestone is included.

EFFECT OF LIMESTONE

In Series A all the land, fertilized and unfertilized alike, has been dressed with finely ground limestone, applied at the rate of 2 tons per acre, every second season; while in Series B the limestone

has been applied annually at the rate of 1 ton per acre to Plot 33 and to certain of the otherwise fertilized plots. The effect of the liming is shown by the increased yield of the unfertilized checks in Series A over those in Series B; the increase found on Plot 33; the increase on Plot 25, receiving both manure and limestone, over that on Plots 24 and 27, receiving manure only; and that on Plot 31, receiving fertilizers and limestone, over that on Plot 30, receiving fertilizers only.

EFFECT OF LIMESTONE

Plots compared	Value of increase per acre from lime				
	Sweet corn	Cucumbers	Cabbage	Tomatoes	Average
Checks, series A over B	$16	$35	$32	$103	$47
Plot 33	15	10	68	21	28
Plot 25 over 24 and 27	5	35	12	15	19
Plot 31 over 30	5	—6	53	0	13

While there is considerable irregularity in the outcome there is no room to doubt that the liming has much more than paid its cost in all the crops.

EFFECT OF MANURE

Where manure is used the rate of application is 16 tons per acre on every crop. The almost complete displacement of the horse on city streets by electric cars and auto vehicles has made it increasingly difficult to secure a sufficient supply of manure for the market garden. For two years manure was obtained for these experiments from the military post at Chillicothe. Since the abandonment of that post the manure has been shipped from Columbus; but at a cost which has amounted to more than five dollars a ton, spread on the land at the Truck farm.

Not only is such manure expensive, but its composition is very uncertain. Considering the results following exposure of manure to the weather at the Experiment Station at Wooster, it is probable that the manure used in these experiments has not averaged more than about 8 pounds each of nitrogen and potash and 4 pounds of phosphoric acid per ton.

A ton of nitrate of soda should contain 300 pounds of nitrogen. At $60 a ton for the nitrate the cost of nitrogen would be 20 cents a pound. A ton of 16 percent acid phosphate would carry 320 pounds of phosphoric acid, which at 6 cents a pound would amount to $19.20. A ton of muriate of potash should carry 1,000 pounds of potash, which would cost 6 cents a pound, if the muriate were priced at $60 a ton. If we disregard the cost of application, which

is greater for manure than for fertilizers, the constituents of a ton of manure of the composition above estimated would have a total value at these prices of $2.32, or less than half the actual cost of the manure in this particular case, provided these constituents were as effective, pound for pound, as those in the chemicals above named.

The experiment furnishes no opportunity for a strict comparison between manure and chemicals because nitrogen and potash are not given in any of the chemical dressings in quantities comparable with those carried in manure. The following comparisons, however, are suggestive:

COMPARISON OF MANURE AND CHEMICALS

Plot	Treatment	Fertilizing constituents			Total value of produce
		Nitrogen	Phosphoric acid	Potash	
3	Manure, limestone	128	64	128	$330
8	Chemicals, limstone	25	64	25	310
2	Manure, limestone	128	128	128	342
6	Chemicals, limestone	50	128	50	340
24					
27	Manure	128	64	128	335
30	Chemicals	25	64	25	299
25	Manure, limestone	128	64	128	354
31	Chemicals, limestone	25	64	25	302

In three of these comparisons, in which it is estimated that nitrogen and potash are given in manure in 5 times the quantities that are carried in the chemicals, and the phosphoric acid in the same quantities in manure and chemicals, the yield is considerably larger for the manure than for the chemicals. When, however, the quantities of nitrogen and potash are doubled in the chemicals and unchanged in the manure, the difference in total effect is insignificant between the neighboring plots 2 and 6, and that between 2 and 28, although larger, is still below what would be expected from the difference in composition. This difference between the outcome on Plots 2 and 28 is probably due to differences in soil conditions and not to differences in manure. It is no greater than the differences shown between some of the untreated plots.

In considering this experiment it must be remembered that no leguminous crop is being grown except the cover crop of cowpeas on part of the land. This cover crop is altogether insufficient to furnish the nitrogen required by the four main crops, and this explains the large response to nitrogen in the fertilizer.

This principle is illustrated in the experiment in continuous and rotative cropping that has been running at Wooster since 1894. Corn, oats, and wheat are each grown continuously and also in a 5-year rotation of corn, oats, wheat, clover, and timothy. Each grain crop receives nitrate of soda in two quantities, carrying 25 and 50 pounds of nitrogen per acre in the continuous cropping and 25 and 38 pounds in the rotative cropping, the nitrate being supplemented with acid phosphate and muriate of potash, which are given in equal quantities for each comparison. The average increase per acre from the different treatments is shown below for the 10 years, 1909-1918:

INCREASE IN CONTINUOUS AND ROTATIVE CROPPING AT WOOSTER

Cropping	Nitrogen per acre	Increase per acre		
		Corn	Oats	Wheat
	Lb.	*Bu.*	*Bu.*	*Bu.*
Continuous	25	22	20	12
	50	35	25	16
Rotative	25	21	21	17
	38	22	20	17

In the continuous cropping doubling the nitrogen has raised the increase by 25 to 60 percent, while in the rotative cropping an increase of 50 percent in the nitrogen has had practically no effect on the yield.

The largest gain, both total and net, in this truck crop experiment, if manure be rated at not over $2.00 a ton, is found on Plot 26. This plot receives the full dose of 16 tons of manure and also 610 pounds of a complete fertilizer, and 1 ton of limestone. The combination carries about 150 pounds of nitrogen, or nearly what would be carried in 1,000 pounds of nitrate of soda; as much phosphoric acid as would be found in 800 pounds of 16 percent acid phosphate; and as much potash as would be carried in 360 pounds of muriate of potash—a total of more than a ton of these chemicals.

TABLE 4.—Fertilizers, lime, and manure on CORN grown in rotation with soybeans, wheat, and clover, Washington County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot
		Block B				Block A				7-year average				
1	None	39.14	2,810			41.29	2,070			38.83	2,280			1
2	Acid phosphate, 200 lb	44.57	2,710	7.95	40	51.57	2,220	9.28	143	45.02	2,580	5.26	203	2
3	Acid phosphate, 200 lb.; muriate potash, 50 lb	31.57	2,770	—2.52	240	64.57	2,560	21.28	477	46.79	2,699	6.09	225	3
4	None	31.57	2,390			44.29	2,090			41.64	2,571			4
5	Acid phos., 200 lb.; mur. pot., 50 lb.; nit. soda, 50 lb.	26.86	2,710	—6.47	353	64.14	2,670	20.04	643	47.79	2,836	6.10	308	5
6	Acid phos., 200 lb.; mur. pot., 50 lb.; nit. soda, 50 lb. ground limestone, 2,000 lb	40.86	2,640	5.76	317	62.86	2,730	18.96	767	52.11	2,911	10.39	426	6
7	None	36.86	2,290			43.71	1,900			41.77	2,441			7
8	Acid phos., 125 lb.; mur. potash, 90 lb.; nit. soda, 200 lb.	46.86	2,860	10.81	563	66.71	2,860	23.52	920	52.86	2,802	13.17	431	8
9	Acid phos., 375 lb.; mur. potash, 90 lb.; nit. soda, 300 lb.	47.29	2,690	12.05	387	63.00	2,730	20.34	750	53.24	2,802	15.64	500	9
10	None	34.43	2,310			42.14	2,020			35.53	2,233			10
	Average unfertilized yield	35.50	2,450			42.86	2,020			39.44	2,381			
	Average fertilized yield	39.67	2,730			62.14	2,628			49.63	2,772			
		Block F				Block E				7-year average				
11	None	45.00	3,260			30.29	1,850			45.35	3,018			11
12	Sheep manure, 2 tons	56.43	3,610	10.53	370	46.71	2,190	15.09	353	56.36	3,332	11.81	346	12
13	Sheep manure, 2 tons; acid phosphate, 250 lb	52.29	3,650	5.48	430	48.14	2,290	15.18	467	53.81	3,359	10.06	405	13
14	None	47.71	3,200			34.29	1,810			42.94	2,921			14
15	Sheep manure, 2 tons; acid phosphate, 400 lb	52.00	3,430	2.57	180	53.71	2,380	19.37	547	53.06	3,386	10.55	471	15
16	Sheep manure, 4 tons; acid phosphate, 400 lb	54.71	3,770	3.57	470	60.43	2,610	26.05	753	54.54	3,351	12.47	443	16
17	None	52.86	3,350			34.43	1,880			41.64	2,902			17
18	Sheep manure, 4 tons; acid phos., 400 lb.; ground limestone, 2,000 lb	59 86	3,630	7.81	277	45.57	2,160	16.47	407	56.41	3,340	14.57	401	18
19	Horse manure, 4 tons; acid phosphate, 400 lb	50.14	3,430	—1.10	73	40.86	2,050	17.10	423	50.68	3,371	8.65	395	19
20	None	50.43	3,360			18.43	1,500			42.24	3,013			20
	Average unfertilized yield	49.00	3,292			29.36	1,760			43.04	2,661			
	Average fertilized yield	54.24	3,587			49.24	2,280			54.14	3,356			

TABLE 5.—Fertilizers, lime, and manure on WHEAT grown in rotation with corn, soybeans, and clover, Washington County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre	1920				1921				Average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	Grain Bu.	Straw Lb.	
		Block D				Block C				6-year average				
1	None	5.33	380			9.92	1,400			7.61	742			1
2	Acid phosphate, 200 lb.	16.17	1,630	11.06	1,287	14.46	2,250	3.76	833	13.35	1,452	5.28	660	2
3	Acid phosphate, 200 lb.; muriate potash, 20 lb.	16.33	1,670	11.44	1,363	18.79	1,372	7.32	—61	13.74	1,260	5.21	419	3
4	None	4 67	270			12.25	1,450			8.99	890			4
5	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 80 lb.	21.17	2,050	15.50	1,657	23.58	2,850	11.22	1,317	18.99	2,125	9.31	1,114	5
6	Acid phos., 200 lb.; mur. pot., 20 lb.; nitrate soda, 80 lb.*	24.83	2,510	18.16	1,993	20.78	3,150	8.31	1,533	20.32	2,397	9.95	1,264	6
7	None	7.67	640			12.58	1,700			11.07	1,253			7
8	Acid phos., 125 lb.; mur. pot., 90 lb.; nitrate soda, 200 lb.	29.33	2,540	21.55	1,907	22.33	2,759	11.64	1,317	21.51	2,341	11.27	1,209	8
9	Acid phos., 375 lb.; mur. pot., 90 lb.; nitrate soda, 300 lb.	29.00	3,260	21.11	2,633	22.96	2,950	14.15	1,783	21.96	2,545	12.56	1,535	9
10	None	8.00	620			6.92	900			8.57	888			10
	Average unfertilized yield	6.42	475			10.42	1,362			9.06	943			
	Average fertilized yield	22.80	2,287			20.48	2 554			18.31	2,020			
		Block H				Block G				6-year average				
11	None	8.17	1,010			12.67	1,050			12.24	1,234			11
12	Sheep manure, 2 tons	14.83	1,310	8.83	553	21.50	3,000	9.44	1,717	16.62	1,734	5.14	525	12
13	Sheep manure, 2 tons; acid phosphate, 250 lb.	22.50	1,950	18.66	1,447	20.62	2,850	9.18	1,333	19.59	2,081	8.86	896	13
14	None	1.67	250			10.83	1,750			9.98	1,159			14
15	Sheep manure, 2 tons; acid phosphate, 400 lb.	23.33	2,300	20.33	1,913	21.92	3,150	10.94	1,633	20.22	2,189	9.85	1,056	15
16	Acid phosphate, 400 lb. (manure on corn)	17.58	1,945	13.24	1,422	17.12	2,200	5.98	917	17.02	2,092	6.25	984	16
17	None	5.67	660			11.29	1,050			11.16	1,082			17
18	Acid phosphate, 400 lb. (manure and limestone on corn)	25.17	2,790	19.87	2,158	24.58	3,350	14.00	2,217	21.26	2,337	10.48	1 291	18
19	Horse manure, 4 tons; acid phospate, 400 lb.	25.75	2,705	20.81	2,102	21.50	3,150	11.62	1,933	20.80	2,400	10.39	1,391	19
20	None	4.57	575			9.17	1,300			10.04	972			20
	Average unfertilized yield	5.02	624			10.99	1,287			10.85	1,111			
	Average fertilized yield	21.53	2,167			21.21	2,950			19.25	2,139			

*Ground limestone, 2,000 lb. on corn.

TABLE 6.—Fertilizers, lime, and manure on SOYBEANS and CLOVER grown in rotation with corn and wheat, Washington County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on	Soybean hay						Clover hay						Plot
		1920		1921		Average		1920		1921		Average		
		Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	
		Block C		Block B		6-year average		Block A		Block D		5-year average		
1	None	3,200		3,467		2,819		746		756		1,001		1
2	Acid phosphate, 100 lb	3,400	—133	3,911	829	3,275	487	1,058	297	1,164	453	1,507	469	2
3	Acid phosphate, 100 lb.; muriate potash, 20 lb	3,750	—117	3,111	415	2,915	158	987	211	1,253	586	1,563	486	3
4	None	4,200		2,311		2,725		791		622		1,115		4
5	Acid phos.; 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.	4,350	150	2,400	30	2,963	199	1,191	379	2,080	1,313	1,769	581	5
6	Acid phos.; 100 lb.; mur. potash, 20 lb.; nit. soda, 30 lb.*	5,900	1,700	2,756	326	3,753	950	1,200	368	2,453	1,540	2,302	1,042	6
7	None	4,200		2,489		2,841		853		1,058		1,333		7
8	(Fertilized on corn and wheat only)	4,450	633	2,489	385	3,088	437	1,111	365	1,778	759	1,820	471	8
9	(Fertilized on corn and wheat only)	3,900	467	1,956	236	2,948	487	889	249	1,929	948	1,979	613	9
10	None	3,050		1,333		2,270		533		942		1,381		10
	Average unfertilized yield	3,662		2,400		2,664		731		844		1,207		
	Average fertilized yield	4,292		2,770		3,157		1,073		1,776		1,823		
		Block G		Block F		6-year average		Block E		Block H		5-year average		
11	None	4,170		3,378		3,326		498		711		1,330		11
12	(Manured on corn and wheat only)	4,640	610	3,733	503	3,905	662	978	400	1,849	1,088	2,221	849	12
13	(Manured and fertilized on corn and wheat only)	4,050	160	3,644	563	3,417	257	1,520	862	1,884	1,072	2,490	1,078	13
14	None	3,750		2,933		3,077		738		862		1,454		14
15	(Manured and fertilized on corn and wheat only)	4,100	300	3,378	193	3,566	369	933	148	2,089	1,197	2,450	971	15
16	(Manured and fertilized on corn and wheat only)	4,450	600	3,200	—237	3,522	205	1,467	634	1,876	955	2,528	1,024	16
17	None	3,900		3,689		3,436		880		951		1,529		17
18	(Manured, limed and fertilized on corn and wheat only)	6,000	2,267	4,133	681	4,167	873	1,431	569	2,204	1,342	2,738	1,141	18
19	(Manured and fertilized on corn and wheat only)	4,050	483	3,689	474	3,568	417	1,609	764	2,347	1,574	3,062	1,398	19
20	None	3,400		2,978		3,008		827		684		1,732		20
	Average unfertilized yield	3,805		3,244		3,212		736		802		1,511		
	Average fertilized yield	4,548		3,629		3,691		1,323		2,041		2,581		

*Ground limestone, 2,000 lb. on corn.

TABLE 7.—Total fertilizing constituents per acre for 4-year period; value of increase and cost and balance from chemical fertilizer and manure, Washington County Experiment Farm

Plot	Fertilizing constituents				Value of increase	Cost* of treatment and balance			
						Chemical valuation		Manure valuation	
	Ammonia	Phosphoric acid	Potash	Limestone		Cost	Balance	Cost	Balance
No.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
2	.....	80	.....	.....	14.95	5.00	9.95	.....	.....
3	.....	80	45	.....	12.73	7.70	5.03	.....	.....
5	30	80	45	.....	18.48	12.50	5.98	.....	.....
6	30	80	45	2,000	29.58	16.50	13.08	.....	.....
8	76	40	90	.....	25.54	20.00	5.54	.....	.....
9	114	120	90	.....	29.61	31.00	−1.39	.....	.....
12	140	40	96	.....	21.45	20.00	1.45	2.00	19.45
13	140	120	96	.....	22.90	25.00	−2.10	7.00	15.90
15	140	168	96	.....	24.72	27.70	−2.98	10.00	14.72
16	140	168	96	.....	21.00	27.70	−6.70	10.00	11.00
18	140	168	96	2,000	32.09	31.70	0.39	14.00	18.00
19	136	168	120	.....	27.00	28.30	−1.30	12.00	15.00

*See values page 452.

TABLE 8.—Fertilizers, lime, and manure on TRUCK CROPS, Washington County Experiment Farm. Yield and increase in pounds per acre. (For plan of treatment, see page 458)

Plot	Sweet corn		Cucumbers		Cabbage		Tomatoes		Average	
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
Series A, 1920										
1	8,760	.....	23,840	.....	15,240	.....	7,600	.....	13 860	.....
2	9,040	333	31,520	5,253	18,280	3,027	11,920	4,707	17 690	3,330
3	9,720	1,067	31,100	2,407	18,160	2,893	11,140	4,313	17,530	2,670
4	8,600	.....	31,120	.....	15,280	.....	6,440	.....	15,360	.....
5	8,600	240	39,160	8,180	17,840	2,840	11,440	4,920	19,260	4,045
6	8,480	360	39,730	8,890	19,120	4,400	11,320	4,720	19,662	4,592
7	7,880	.....	30,700	.....	14,440	.....	6,680	.....	14,925	.....
8	9,400	1,333	34,400	3,273	18,440	4,067	10,060	3,073	18,075	2,936
9	9,560	1,307	39,560	8,007	17,080	2,773	8,340	1,047	18,635	3,283
10	8,440	.....	31,980	.....	14,240	.....	7,600	.....	15,565	.....
11	8,840	533	31,060	—140	14,960	1,133	8,540	1,520	15,850	761
12	8,880	707	30,900	480	14,360	947	6,940	500	15,270	658
13	8,040	.....	29,640	.....	13,000	.....	5,860	.....	14,135	.....
14	9,080	1,320	26,660	—567	14,480	1,693	7,000	1,426	14,305	968
15	8,480	1,000	24,700	—113	13,200	627	6,240	954	13,155	617
16	7,200	.....	22,400	.....	12,360	.....	5,000	.....	11,740	.....
*	8,153	.....	28,280	.....	14,093	.....	6,530	.....	14,264	.....
†	9,008	.....	32,879	.....	16,592	.....	9,294	.....	16,943	.....
Series A, 1921										
1	8,680	.....	21,800	.....	18,200	.....	5,990	.....	13,667	.....
2	9,120	227	36,040	13,707	23,120	4,454	9,570	3,517	19,462	5,476
3	9,520	413	38,080	15,213	22,400	3,267	8,370	2,253	19,592	5 286
4	9,320	.....	23,400	.....	19,600	.....	6,180	.....	14,625	.....
5	10,800	1,627	30,920	6,420	22,360	2,986	7,960	1,497	18,010	3,132
6	9,360	333	32,760	7,160	23,360	4,214	8,250	1,503	18,432	3,302
7	8,880	.....	26,700	.....	18,920	.....	7,030	.....	15,382	.....
8	8,840	53	25,720	1,973	21,800	2,534	8,590	1,730	16,237	1,572
9	9,040	347	21,960	1,167	22,360	2,746	7,270	580	15,157	1,210
10	8,600	.....	17,840	.....	19,960	.....	6,520	.....	13,230	.....
11	8,760	146	18,600	1,640	20,920	1,466	7,090	710	13,842	990
12	8,440	—187	20,460	4,380	19,960	1,014	6,820	580	13,920	1,447
13	8,640	.....	15,200	.....	18,440	.....	6,100	.....	12,095	.....
14	8,840	174	17,140	2,600	20,280	2,520	6,690	500	13,237	1,448
15	9,040	347	17,640	3,760	20,800	3,720	6,240	—40	13,430	1,947
16	8,720	.....	13,220	.....	16,400	.....	6,370	.....	11,177	.....
*	8,806	.....	19,693	.....	18,587	.....	6,365	.....	13 363	.....
†	9,176	.....	25,932	.....	21,736	.....	7,685	.....	16,132	.....
Series A, 7-year average										
1	7,600	.....	14,674	.....	15,737	.....	10,601	.....	12,153	.....
2	7,831	356	19,500	4,805	20,877	5,029	14,425	3,801	15,658	3,498
3	7,817	466	18,548	3,831	20,057	4,099	13,941	3,292	15,091	2,922
4	7,225	.....	14,740	.....	16,068	.....	10,673	.....	12,176	.....
5	8,137	981	18,844	3,734	19,291	3,371	13,403	2,817	14,919	2,726
6	8,085	999	19,364	3,884	21,605	5,235	13,927	3,428	15,595	3,386
7	7,017	.....	15,850	.....	15,623	.....	10,413	.....	12,226	.....
8	7,723	665	18,681	3,015	19,094	3,637	12,175	1,758	14,418	2,269
9	7,986	887	18,883	3,401	18,768	3,477	12,531	2,110	14,542	2,469
10	7,140	.....	15,297	.....	15,125	.....	10,425	.....	11,997	.....
11	7,791	657	16,833	1,795	16,805	1,895	11,828	1,626	13,314	1,493
12	7,294	166	15,753	974	16,074	1,379	10,144	162	12,316	670
13	7,123	.....	14,520	.....	14,480	.....	9,761	.....	11,471	.....
14	7,385	244	14,913	835	15,771	1,779	9,380	—144	11,862	678
15	7,457	296	15,430	1,795	15,485	1,981	9,340	53	11,928	1,031
16	7,180	.....	13,193	.....	13,017	.....	9,050	.....	10,610	.....
*	7,214	.....	14,712	.....	15,009	.....	10,153	.....	11,772	.....
†	7,751	.....	17,675	.....	18,323	.....	12,109	.....	13,964	.....

*Average unfertilized yield. †Average fertilized yield.

TABLE 9.—Fertilizers, lime, and manure on TRUCK CROPS, Washington County Experiment Farm. Yield and increase per acre.
(For plan of treatment, see page 458)

Plot	Sweet corn		Cucumbers		Cabbage		Tomatoes		Average	
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
Series B, 1920										
21	5,800	—1,480	13,800	—240	8,520	—3,880	3,360	—1,640	7,870	—1,810
22	7,280	.....	14,040	.....	12,400	.....	5,000	.....	9,680	.....
23	10,760	2,500	28,440	6,940	20,880	8,360	10,600	4,850	17,670	5,662
24	10,920	2,660	34,480	12,980	19,720	7,200	9,660	3,910	18,695	6,687
25	10,640	2,380	37,980	16,480	19,680	7,160	11,340	5,590	19,910	7,902
26	10,960	2,700	45,480	23,980	21,760	9,240	13,340	7,590	22,885	10,877
27	11,200	2,940	37,840	16,340	18,840	6,320	12,340	6,590	20,055	8,047
28	10,840	2,580	38,640	17,140	19,280	6,760	13,560	7,810	20,580	8,572
29	9,240	.....	28,960	.....	12,640	.....	6,500	.....	14,335	.....
30	10,200	1,000	34,260	5,507	15,560	4,020	9,400	2,300	17,355	3,456
31	9,400	240	35,560	7,013	16,480	6,040	8,480	2,780	17,480	4,018
32	9,120	.....	28,340	.....	9,340	.....	5,300	.....	13,025	.....
33	9,360	613	30,080	4,260	12,720	3,280	5,800	727	14,490	2,220
34	9,320	947	33,040	9,740	15,680	6,140	7,360	2,513	16,350	4,835
35	8,000	.....	20,780	.....	9,640	.....	4,620	.....	10,760	.....
36	6,280	—1,720	24,500	3,720	14,400	4,760	6,020	1,400	12,800	2,040
*	8,410	.....	23,030	.....	11,005	.....	5,355	.....	11,950	.....
†	11,060	.....	36,160	.....	19,280	.....	11,000	.....	19,375	.....
Series B, 1921										
21	3,360	—3,160	9,840	—4 620	11,600	—4,600	3,040	—1,390	6,960	—3,442
22	6,520	.....	14,460	.....	16,200	.....	4,430	.....	10,402	.....
23	8,000	680	27,800	13,550	25,580	9,970	8,130	3,095	17,377	6,824
24	10,160	2,840	28,000	13,750	23,320	7,710	7,200	2,165	17,170	6,616
25	9,720	2,400	37,600	23,350	24,680	9,070	7,750	2,715	19,937	9,384
26	8,560	1,240	39,880	25,630	28,400	12,790	8,390	3,355	21,307	10,754
27	9,400	2,080	32,180	17,930	23,160	7,550	8,290	3,255	18,257	7,704
28	10,240	2,920	36,480	22,230	26,560	10,950	8,530	3,495	20,452	9,899
29	8,120	.....	14,040	.....	15,020	.....	5,640	.....	10,705	.....
30	9,320	1,440	20,300	8,006	21,720	6,520	6,720	1,417	14,515	4,346
31	9,000	1,360	15,760	5,214	22,640	7,260	6,540	1,574	13,485	3,852
32	7,400	.....	8,800	.....	15,560	.....	4,630	.....	9,097	.....
33	8,520	1,147	6,120	—2,114	18,200	1,960	4,690	130	9,382	281
34	8,760	1,414	7,520	—146	23,440	6,520	6,440	1,950	11,540	2,434
35	7,320	.....	7,100	.....	17,600	.....	4,420	.....	9,110	.....
36	6,880	—440	6,860	—240	21,560	3,960	5,700	1,280	10,250	1,140
*	7,340	.....	11,100	.....	16,095	.....	4,780	.....	9,829	.....
†	9,780	.....	30,090	.....	23,240	.....	7,745	.....	17,714	.....
Series B, 7-year average										
21	5,674	—340*	12,227	1,854	12,657	—1,508	6,854	—1,000	9,353	—225
22	5,914	.....	10,381	.....	14,165	.....	7,854	.....	9,578	.....
23	8,314	1,888	19,628	7 153	23,397	9,110	13,200	5,142	16,133	5,823
24	8,603	2,177	19,408	6,933	21,103	6,814	12,867	4 809	15,495	5,183
25	8,768	2,343	22,348	9,873	22,063	7,776	13,355	5,298	16,633	6,322
26	8,757	2,331	26,113	13,637	24,377	10,090	13,291	5,233	18,134	7,823
27	8,620	2,194	21,024	8,548	20,297	6,010	13,033	4,975	15,743	5,432
28	9,128	2,703	23,464	10,988	21,697	7,410	13,701	5,643	16,997	6,686
29	6,937	.....	14,570	.....	14,409	.....	8,261	.....	11,044	.....
30	8,063	1,219	20,480	6,209	19,126	5,216	9,886	2,271	14,389	3,729
31	8,194	1,444	19,795	5,824	21,291	7,881	9,247	2,278	14,632	4,357
32	6,657	.....	13,673	.....	12,911	.....	6,323	.....	9,891	.....
33	7,240	774	13,408	698	16,091	3,436	6,960	622	10,925	1,382
34	7,683	1,409	15,575	3,828	20,063	7,664	9,347	2,994	13,167	3,974
35	6,083	.....	10,785	.....	12,143	.....	6,368	.....	8,845	.....
36	6,494	411	12,050	1,264	16,234	4,091	8,078	1 710	10,714	1,869
*	6,399	.....	12,352	.....	13,407	.....	7,201	.....	9,840	.....
†	8,611	.....	20,216	.....	20,700	.....	12,950	.....	15,619	.....

*Average check plots 22, 29, 32, and 35. †Average check plots 24 and 27.

TABLE 10.—Seven-year average annual value of TRUCK CROPS and of the increase due to treatment, cost of treatment, and balance. Washington County Experiment Farm. (For plan of treatment, see page 458)

Plot	Annual value of yield and increase								Average		Cost of treatment	Balance
	Sweet corn		Cucumbers		Cabbage		Tomatoes					
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase		
	Series A; Basic treatment, limestone and cover crops											
1	$152	.....	$210	.....	$315	.....	$371	.....	$264	.....	.....	.....
2	157	$ 7	292	$72	417	$101	504	$133	342	$78	$36	$42
3	156	9	278	57	401	82	487	115	330	65	32	33
4	144	.....	221	.....	321	.....	373	.....	265	.....	.....	.....
5	163	20	282	55	386	67	469	98	325	60	32	28
6	162	20	291	58	420	105	487	119	340	75	21	54
7	140	.....	237	.....	312	.....	364	.....	263	.....	.....	.....
8	154	13	280	45	382	73	426	62	310	48	11	37
9	160	18	283	51	375	69	439	75	314	53	9	44
10	143	.....	229	.....	302	.....	364	.....	259	.....	.....	.....
11	156	13	252	27	336	38	413	56	289	33	4	29
12	146	3	236	15	321	28	355	6	264	13	5	8
13	142	.....	217	.....	289	.....	341	.....	247	.....	.....	.....
14	147	5	223	12	315	35	327	—4	253	12	5	7
15	149	6	231	27	309	39	326	2	254	18	5	13
16	144	.....	193	.....	260	.....	316	.....	228	.....	.....	.....
*	$144	.....	$220	.....	$300	.....	$355	.....	255	.....	.....	.....

TABLE 10.—Seven-year average annual value of TRUCK CROPS and of the increase due to treatment, cost of treatment, and balance. Washington County Experiment Farm. (For plan of treatment, see page 458)—Continued

Plot No.	Annual value of yield and increase								Average annual yield		Cost of treatment	Balance
	Sweet corn		Cucumbers		Cabbage		Tomatoes					
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase		
	Series B: Basic treatment, cover crop											
21	$113	$—5	$183	$ 27	$253	$—30	$239	$—35	$197	$—11	.....	.....
22	118	.....	156	.....	283	.....	274	.....	208	.....	.....	.....
23	166	45	294	129	468	185	462	186	347	136	43	93
24	172	48	291	117	422	138	450	172	334	119	32	87
25	175	48	334	151	441	156	467	187	354	135	37	98
26	175	45	391	199	487	201	465	183	379	157	46	110
27	172	39	315	114	406	119	456	172	337	111	32	79
28	182	46	351	141	434	146	479	193	361	131	42	89
29	139	.....	219	.....	288	.....	288	.....	233	.....	.....	.....
30	161	24	307	93	382	104	345	80	299	75	11	64
31	164	29	297	87	426	157	323	80	302	88	16	72
32	133	.....	205	.....	258	.....	220	.....	204	.....	.....	.....
33	145	15	201	10	322	68	244	21	228	28	5	23
34	153	28	234	57	401	153	326	104	278	85	14	71
35	121	....	162	.....	243	.....	223	.....	187	.....	.....	.....
36	130	8	180	18	325	82	282	59	229	42	9	33
*	$128	.....	$185	.....	$268	.....	$252	.....	208	.....	....	....
†	172	.....	303	.....	414	.....	452	.....	335	.....	.....	.....

*Av. 22, 29, 32, 35. †Av. 24, 27.

Valuations: Sweet corn and cabbage, 2 cents per lb; cucumbers, 1½ cent; tomatoes, 3½ cents. Ground limestone, $5.00 per ton; manure $2.00 per ton; acid phosphate, 1 cent per lb.; nitrate of soda and muriate of potash, 3 cents per lb.

In this table the increases are computed progressively from Plot 22 to Plot 29.

COMPARISON OF VARIETIES

DEPARTMENT OF AGRONOMY

CORN

Of the seven varieties of corn tested on the Washington County Experiment Farm at Fleming, 4 have been grown for a period of 8 years, 2 for 7 years, and 1 for 5 years. Table 11.

TABLE 11.—VARIETIES OF CORN, YIELD PER ACRE AND 8-YEAR* AVERAGE

Variety	1920	1921	8-year average	
			Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Lb.*
Leaming	48.22	63.23	53.06	2,903
Ried (Orcutt)	.....	.....	53.79	3,791†
Cook's 75	55.27	59.77	62.24	3,443‡
Ohio 84	53.52	57.57	52.22	3,022
Clarage	52.98	60.62	52.51	3,091
Connor's Prolific	56.56	51.86	55 81	3,918‡
Darke Co. Mammoth	51.89	58.14	54.81	3,935

*For the annual yields for 1914-1919, see Ohio Agr. Exp. Sta. Bul. 344, part 5.
†5 years. ‡7 years.

On the basis of ear-corn at husking time, Cook's 75—a strain of Reid's from Hardin County—leads with 62.24 bushels per acre. Connor's Prolific is second and Darke County Mammoth, third. These are late-maturing varieties carrying more water at husking time than the early sorts, Clarage and Ohio 84. On a dry shelled corn basis, the difference between the yields of early and late varieties would not be so great. Darke County Mammoth has the highest stover yield with Connor's Prolific second.

TABLE 12.—VARIETIES OF WHEAT, YIELD PER ACRE AND 6-YEAR AVERAGE

Variety	1916	1917	1918	1919	1920	1921	6-year average	
							Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Trumbull	14.26	16.96	.....	20.43	14.17	18.31	16.83	1,847
Ohio 9920	19.90	18.29	10.43	31.48	20.33	22.30	20.45	1,798
Red Wave	14.82	11.68	11 54	24.76	12.00	19.49	15.71	1,737
Gladden	21.68	23.58	13.63	26.65	22.92	23.37	21.97	2,649
Nigger	21.82	23.46	11.54	28.82	24.92	22.88	22.24	2,152
Mediterranean	20.27	25.79	.....	30.26	.....	23.69	25.00	2,785
Velvet Chaff	14.96	19.29	11.54	24.54	17.08	21.41	18.13	1,923

WHEAT

Seven varieties of wheat have been tested since 1916. Table 12. Mediteranean has the highest average yield, Nigger second, and Gladden third. These three varieties also lead in yield of straw.

SOYBEANS—SEED AND HAY

Seven varieties of soybeans were tested for yield of seed for the 2 years of 1915 and 1916. In 1915, Hamilton lead; Midwest came second; and Elton, third. In 1916, Elton was first; Ebony, second; and Ohio 9100, third. Cowpeas gave a very low yield of seed.

TABLE 13.—VARIETIES OF SOYBEANS, YIELD PER ACRE AND 2-YEAR AVERAGE

Variety	1915	1916	2-year average	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Midwest*	18.68	10.72	14.70	4,440
Elton	17.73	13.95	15.84	2,980
Ebony	11.40	13.10	12.25	2,550
Ohio 9100	17.34	12.61	14.97	2,800
Hamilton (Ohio 9035)	22.57	10.89	16.73	4,915
Medium Green	11.62	9.16	10.39	3,098
New Era Cowpea	1.50	1.67	1.58	4,005

*Correct name for Hollybrook, Mongol, Roosevelt, and Medium Yellow.

The hay test (Table 14) of seven varieties for 4 years shows a slight lead for Medium Green. The differences in yields, except for Mammoth Yellow, are not great. Mammoth Yellow has shown a low hay yield, as in all other tests in the State. This variety is late-maturing, seed being produced in southern states.

TABLE 14.—VARIETIES OF SOYBEANS FOR HAY, YIELDS PER ACRE AND 4-YEAR AVERAGE

Variety	1918	1919	1920	1921	Average	
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Tons*
Ebony	.....	3,500	3,429	4,168	3,699	1.85
Hamilton (Ohio 9035)	3,750	4,350	2,945	5,492	4,134	2.06
Auburn	3,600	4,000	.....	4,792	4,131	2.06
Ohio 9100	3,700	3,750	4,162	4,968	4,145	2.07
Cloud	3,800	3,600	.....	4,278	3,893	1.94
Mammoth Yellow	2,550	.....	2,996	4,612	3,386	1.69
Medium Green	3,737	3,737	4,012	5,145	4,158	2.07

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BULLETIN

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COUNTY EXPERIMENT FARMS IN OHIO

PART VI

THE TRUMBULL COUNTY EXPERIMENT FARM

SIXTH AND SEVENTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

C. W. MONTGOMERY, CHIEF OF DEPARTMENT

J. P. MARKLEY, SUPERINTENDENT
J. H. WELDAY AND E. W. CHUBB, FOREMEN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$15,388.00	$15,388.00
Permanent improvements to March 1, 1920 and 1921	7,364.91	7,552.95
Permanent improvements made during year ended		
1920—Cinders around barn, $36.46; indoor closet, $104.37; fences, $47.21—total	188.04	
1921—Concrete floors in granary		46.58
Total permanent investment	$22,940.95	$22,987.53
Operating equipment:		
Livestock:		
1920—4 horses, $705; 35 cattle, $3,260—total	$ 3,965.00	
1921—4 horses, $705; 35 cattle, $2,935—total		$ 3,640.00
Machinery, tools, and harness	2,363.50	2,082.00
Crops and feeds:		
1920—Corn, $86; oats, $280; straw, $125; silage, $340; wheat, $25; hay, $240; potatoes, $20; feed, $15.45—total	1,131.45	
1921—Corn, $65; oats, $36; wheat, $12; hay, $60; straw, $40; potatoes, $37.50; mill feed, $45; stover, $24; silage, $154—total		473.50
Seeds	83.00	10.00
Fertilizer	41.00	
Lumber		18.00
Fence material	54.00	3.00
Dairy equipment	108.00	104.00
Water supply equipment	400.00	350.00
Sundries	53.50	28 50
Total operating equipment	$ 8,199.45	$ 6,709.00
Total investment	31,140.40	29,696.53

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$ 2,000.00	$ 2,000.00
From Farm sales:		
Livestock and products:		
1920—Cattle, $405; calves and hides, $76.80; milk, $2,664.69—total	3,146.49	
1921—Cattle, $175; calves and hides, $119.20; milk and butter, $2,074.36—total		2,368.56
Crops:		
1920—Corn, $20.35; rye, $4.25; straw, $47.40; potatoes, $40.50; apples, $15; hay, $25; wheat, $450.29—Total	702.79	
1921—Corn, $2.25; wheat, $125; rye, $22; straw, $29; potatoes, $34.47—total		212.72
Refund on fertilizer		7.60
To correct error		.02
Sundries	33.90	
Total receipts	$ 5,883.18	$ 4,588.90
Balance brought forward	2,819.64	398.07
	$ 8,702.82	$ 4,986.97

Cr.

By Expenditures*

For labor	$ 3,336.45	$ 3,395.99
For current expense	2,919.92	1,148.61
For permanent improvements:		
1920—Building material, $104.37; sand and gravel, $6.91; water supply, $7.20; fences, $24.95—total	143.43	
1921—Concrete work		16.00
For machinery and tools	1,034.95	23.13
For livestock: Cattle	870.00	
Total expenditures	$ 8,304.75	$ 4,583.73
Balance carried forward	398.07	403.24
	$ 8,702.82	$ 4,986.97

*Itemized current expenses page 479.

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of farm in acres	1920	1921
Farmstead	4	4
Cultivated	89.32	89.05
Permanent pasture	40.72	43.72
Orchard	3.	3.
Roads (farm)	10.35	7.62
Road (public)	6.49	6.49
Total area of farm	153.88	153.88

Plot Work

	1920			1921		
	No. of plots	Acres	Yield per acre	No. of plots	Acres	Yield per acre
Corn	53	5.3	54.6 bu.	53	5.3	39.7 bu.
Corn silage	36	2.6	6.3 tons	30	2.0	10.5 tons
Oats	66	6.2	77.6 bu.	57	6.27	21.7 bu.
Wheat	67	6.15	23.1 bu.	62	5.92	20.9 bu.
Barley				1	.1	5.6 bu.
Clover	74	10.32	1.8 tons	38	4.23	.9 tons
Rye	8	.5	21.0 bu.	3	.25	17.0 bu.
Rye silage	2	.2	2.5 tons			
Soybean silage	10	.5	2.7 tons	2	.2	2.6 tons
Soybean hay	5	.5	.9 tons			
Alfalfa	14	3.33	2.0 tons	15	3.43	3.6 tons
Pea and oat silage	2	.2	2.5 tons	3	.3	1.2 tons
Potatoes	18	.9	110.9 bu.	12	.7	48.9 bu.
Emmer				1	.1	4.2 bu.
Spring wheat				1	.1	2.5 bu.
Timothy				1	.1	1.6 tons
Total	355	36.7		279	29.01	

Field Crops

Corn		1.19	51.6 bu.		4.77	46.4 bu.
Corn silage		11.00	3.8 tons		11.00	8.8 tons
Oats		14.89	42.7 bu.		10.31	30.9 bu.
Wheat		9.38	13.0 bu.		9.32	11.4 bu.
Clover		7.52	1.5 tons		12.01	1.9 tons
Soybean hay		5.00	.9 ton			
Alfalfa		1.11	2.5 tons		1.11	2.3 tons
Pea and oat silage		5.50	3.7 tons		5.50	.8 ton
Rye					5.50	10.0 bu.
Potatoes					.50	24.9 bu.
Total		55.62			60.02	
Less pasture cut for hay		3.00				
		52.62				

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

		Corn	Corn silage	Oats	Wheat	Soy silage	Rye	Potatoes	Clover	Alfalfa
		Bu.	*Tons*	*Bu.*	*Bu.*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*
Highest	1920	75.4	11.5	89.4	35.8	6.2	34.6	143	3.30	3.8
	1921	61.7	11.9	37.5	32.8	4.2	19.0	140	2.20	6.5
Lowest	1920	17.8	2.6	22.8	5.2	2.2	9.0	63	.17	2.9
	1921	20.1	2.0	6.0	9.1	.9	15.0	105	.20	1.5

LABOR

	1920	1921
Number of work horses	4	4
Number crop-acres per work horse	23	22.5
Number man-hours for year beginning March 1	12,404	11,537
Number horse-hours for year beginning March 1	4,373	3,471
Number tractor-hours for year beginning March 1	274	246

ITEMIZED CURRENT EXPENSES

	1920	1921
Seeds	$ 272.56	$ 31.43
Fertilizer	313.69	142 84
Spray material	.30	
Containers	2.05	1.50
Binder twine	25 79	26.43
Plot fixtures	18.40	
Machinery hire	6 00	28.00
Feed and pasture	1,490.44	317.10
Horse shoeing	56 90	38.45
Livestock incidentals	31.27	15.33
Water supply main.	5.23	
Livestock equipment	38.85	14.85
Drainage main.	$ 1.00	$ 0.80
Implement repair	145.55	82.53
Engine main.*	345.40	9.59
Transportation	4.53	15.00
Communication	55.50	35.48
Publicity	20.00	6.25
Office supplies	2.40	2.19
Miscellaneous hdw.	17.74	14.03
Oil and gasoline		269.78
Building main.	47.32	45.18
Veterinary	19.00	51.85
Total	$2,919.92	$1,148.61

*Includes oil and gasoline for 1920.

REPORT OF WORK FOR THE YEARS 1920 AND 1921

J. P. MARKLEY

CLIMATIC CONDITIONS

The winter of 1919-20 was cold and during the early part of the season the ground was covered with snow. Later the ground was covered with ice for several weeks damaging wheat to some extent.

Cold, wet weather in April delayed oats seeding and other spring work. This period of excessive rainfall was followed by dry weather in May which made it difficult to get the land in proper mechanical condition for planting. A heavy rainfall followed in June. Field corn and potatoes were so nearly mature that the first killing frost, October 6, did but little damage.

The winter of 1920-21 was mild and the snowfall very light. Wet weather in April and May delayed oats seeding and corn planting. Then followed a very dry season, causing a light crop of hay, oats, and field corn.

EXPERIMENTAL WORK

The experimental work was continued in 1920 according to the plans of the preceding year. The yields of corn—except on the rotation plots where the stand was poor—of potatoes, oats, and clover were good. Weather conditions caused a low yield of wheat.

In 1921 the tests in date-of-seeding oats and wheat were discontinued and a rotation of seed-selection corn, potatoes, oats, and clover started on Blocks J, K, M, and N. The 2-year rotation of corn and rye for silage; the 2-year rotation of corn and rye and soybeans; and the 4-year rotation of corn, oats, wheat, and clover were discontinued; and a 5-year rotation of corn, corn, oats, alfalfa, and alfalfa; and a 3-year rotation of corn, oats, and sweet clover substituted.

The drainage plots show in a very striking manner the value of tile drains and that on the heavy soils of the Trumbull County Experiment Farm, for desired results the drains should not be more than 35 or 40 feet apart.

Pasture improvement work shows some difference between fertilized and unfertilized plots. In the first and second year of the experiment manure gave better results than either fertilizer or lime alone; however, a combination of manure and fertilizer showed the best results. On account of the weather conditions, the plots that were reseeded showed very little improvement over the plots that were not reseeded.

A shrinkage test with silage corn was made with different varieties to determine the loss in weight from the time it is in the proper stage for putting into the silo until it is mature and cured in the shock.

Four varieties, 1-40 acre each, were cut, weighed, and shocked, at silo-filling time, October 10, 1921; then weighed again at husking time, December 14, with the following results:

Variety	Pounds at silage stage	Pounds at husking	Shrinkage pounds	Shrinkage percent
Darke County Mammoth..	375	260	115	30.7
Old Virginia	736	370	366	49.7
Blue Ridge . .	598	300	298	49.8
Eureka	778	375	403	51.8

FIELD WORK

There are two field rotations on the Trumbull County Experiment Farm; one a 3-year rotation of oats, wheat, and clover, and the other a 4-year dairy rotation of corn, oats and peas, corn, and rye. In the 3-year rotation no manure is used, as the fields are located at some distance from the barn; but fertilizer is used to maintain the fertility of the soil. In the dairy rotation phosphated manure is applied to both corn crops, and 100 pounds of acid phosphate to the oats crop. All crops in the dairy rotation except rye are ensiled.

Corn grown in the fields in 1920 was put in the silo—see cost of silo filling. Owing to the very dry weather in June and July corn made a poor growth in the early part of the season, but rains in late summer and early fall although too late to benefit the field corn improved the silage crop so that there was a fair yield of 8.8 tons per acre.

Peas and oats made a good crop in 1920, but probably would have made better silage had the proportion of peas to oats been larger. This field was seeded to a mixture of clovers and the clover crop plowed down for corn in 1921. The crop of peas and oats in 1921 was less than one ton per acre.

Oats, though not seeded until the middle of May in 1920 on account of wet weather, yielded about 45 bushels per acre. The crop of 1921 failed because of late seeding and dry weather, yielding only 24 bushels per acre.

Wheat in 1921 was damaged by the ice which covered the fields late in the winter. There was also a light wheat crop in 1921 and the grain was of poor quality.

Clover in 1920 made a good growth. In 1921 the crop was light.

Alfalfa produced two good crops of hay in 1920 and, had not weather conditions delayed both cuttings beyond the proper time for harvesting, there would have been a good third crop. Three good crops were harvested in 1921.

SILO FILLING

About 14 acres of corn, mostly of the Old Virginia and Eureka varieties, was put into the silos in 1920. The average distance of hauling was about ¼ mile. The 14-inch cutter and Sampson tractor, owned by the farm, were used in filling. For cutting the field corn, a binder with loader attachment was used and was drawn by a Fordson tractor owned by a neighbor. The corn, which was not cut until two weeks after the heavy frost of October 6, was very dry, and at the time of filling water was pumped into the silo for 15 hours at the rate of 2400 pounds per hour. Approximately 18 tons of water was added raising the total weight to 78 tons and lowering the cost per ton to $8.50. The silage was good, although more water would probably have improved the quality. A poor stand on one field of 5½ acres and on several of the plots lowered the average yield.

COST OF FILLING SILO, 1920 AND 1921

	1920		1921	
	Number	Cost	Number	Cost
Acres	14	.....	11.5	.....
Man-hours	144	$ 50.40	340.5	$115.77
Horse-hours	112	22.40	206.5	47.49
Tractor and loader, acres	10.66	24.38	.....	.....
Binder, hours	12.5	2.50	.....	.....
Tractor and cutter, hours	18.5	41.63	.....	36.02
Meals for silo fillers	20	10.00	.....	.....
Twine, pounds	45	6.75	.....	.....
Total cost	.....	$158.06	.....	$199.28
Value of estimated grain yield	.....	504.00	.....	230.00
Total value	.....	$662.06	.....	$429.28
Amount of silage, tons	60.2	.....	101.5	.....
Yield per acre, tons	4.3	.....	8.8	.....
Cost per acre, dollars	.....	11.29	.....	17.32
Cost per ton, dollars	.....	2.63	.....	1.96
Value per ton, dollars	.....	10.99	.....	4.22

The use of machinery decreased the man-hours, but a part of the extra labor as well as the lower cost per ton for 1921 is due to the heavier yield. The lower value per ton for 1921 is largely due to the lower price for corn. In 1920 corn with stover was rated at $1.05 per bushel, while in 1921 it was rated at 40 cents per bushel.

The larger part of the corn for silage, in 1921, was harvested before frost and the yield was somewhat better than that of the preceding year. The crop was cut by hand and the filling was largely done with the regular farm help. The amount of labor and the cost of filling the silos in 1920 and 1921 are as follows:

DAIRY WORK

There are two Jersey cows in the dairy herd and the remainder are Holsteins, several of which are registered. A registered bull and six registered heifers were purchased in 1920.

The cost of feed consumed by the heifers and calves was greater than their increased valuation as given in the inventory, showing that the immediate profit in dairying is not in the growing of young cattle, however, necessary this may be to build up a high producing herd.

EQUIPMENT

A Sampson tractor and a tractor gang plow were added to the farm equipment in 1920, to take the place of the old tractor which had given trouble and caused delay in the work. The new tractor did satisfactory work both on the belt, and in the field.

FINANCIAL SUMMARY OF THE DAIRY WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Inventory March 1, 1920		Inventory February 28, 1921	
Dairy barn	$ 1,200.00	Dairy barn	$ 1,175.00
2 silos	500.00	2 silos	490.00
Milk house	400.00	Milk house	375.00
Water supply equipment	200.00	Water supply equipment	190.00
Dairy equipment	121.50	Dairy equipment	108.00
14 cows	1,500.00	14 cows	1,600.00
1 bull	150.00	1 bull	200.00
3 calves	60.00	7 calves	210.00
11 heifers	650.00	13 heifers	1,300.00
Total inventory	$ 4,781.50	Total inventory	$ 5,648.00
Man-hours, 3896	1,364.49	Milk sold, 82720 pounds	2,695.42
Horse-hours, 233½	46 70	Milk sold, 142 quarts	11.35
Feed consumed	2,765.29	Milk used, 3064 pounds	99.09
Pasture	290 50	Milk fed to calves	369.87
Milk fed, 11408 pounds	369 87	5 heifers sold	185.00
Hauling milk	172 13	Cow sold	25.00
Association dues	8 25	Bull sold	130.00
Milk testing	5 71	3 calves sold	52.00
Supplies	3 95	Manure produced	748.35
Veterinary and medicine	11.50	To balance (loss)	732.31
1 bull	150.00		
6 heifers	720.00		
Salt	6.50		
Total	$10,696.39	Total	$10,696.39

Average price of rough feed for year: Hay, $21 per ton; corn silage, $10.99; pea and oat silage, $6; stover, $6.

The cost of grain was cost price of that purchased and farm price each month of that grown on the farm. The average price was as follows: corn (ground), $3.04 per cwt.; oats (ground), $2.87; bran, $2.80; oilmeal, $3.67 per cwt.

Interest on investment and overhead charges are not included in the summary.

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Dairy barn	$1,175.00	Dairy barn	$1,151.50
Silos 2	490.00	2 silos	480.20
Milk house	375.00	Milk house	367.50
Water supply equipment	190.00	Water supply equipment	186.20
Dairy equipment	108.00	Dairy equipment	104.00
14 cows	1,600 00	20 cows	2,105.00
1 bull	200.00	2 bulls	325.00
7 calves	210.00	2 calves	25.00
13 heifers	1,300.00	11 heifers	480.00
Total inventory	$5,648.00	Total inventory	$5,224.40
Man-hours, 4155	1,412.72	Milk sold, 107234 pounds	2,216.22
Horse-hours, 200	46.00	Milk sold employees, 2718 lb.	51.07
Feed consumed	1,708.73	Milk used, 3285	68.04
Pasture charge	345.45	Milk fed, 6363	129.65
Milk fed, 6363 pounds	129.65	Butter sold, 50 pound	15.58
Hauling milk	175.49	Heifers sold, 5	180.00
Association dues	10.73	Calves sold, 10	131.83
Council fees	3.54	Cows sold, 2	95.00
Testing milk	10.73	Manure produced, 258.5 T.	322.26
Veterinary services	42.50	To balance (loss)	1,112.51
Dairy equipment	1.80		
Salt	7.36		
Supplies	3.86		
Total	$9,546.56	Total	$9,546.56

Average price of rough feeds for year: Hay, $9.35 per ton; corn silage, $4.22; pea and oat silage, $6.00; stover, $4.00.

The cost of grain was the cost price of that purchased and farm price each month of that grown on the farm. The grain mixture fed was, 4 parts ground corn, 4 parts ground oats, and 1 part cottonseed meal. The average price of the mixture was $1.54 per cwt.

PRODUCTION OF THE DAIRY HERD

	1917	1918	1919	1920	1921
Milk produced per cow, pounds	6,573	7,086	8,579	7,301	6,552
Value of milk per cow, dollars	168.59	215.36	276.37	241.94	135.16
Feed cost per cow, dollars	97.25	104.34	145.20	163.76	80.05
Labor cost per cow, dollars				97.65	55.25

The decrease in production for 1920 and 1921 may be partly accounted for from the fact that the cows in 1919 were mostly matron cows some of which were sold and their places filled in the later years by young cows that have not yet reached their maximum production.

FIELD MEETINGS AND EXHIBITS

More than 1200 were present at the field meeting June 28, 1920. A few days later the County Agent and 65 farmers from Geauga County visited the farm to study the lime and fertilizer experiments. The June field meeting in 1921 was also well attended. The afternoon in the orchard was the notable feature of this meeting.

A farm exhibit of the better varieties of the grains and other crops is made at the Trumbull County fair each year.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

A 4-year rotation of corn, oats, wheat, and clover was begun on this farm in 1915. Corn was grown that year; corn, oats, and wheat in 1916; and the 4 crops in 1917 and each year since. The corn crop of 1916 was frosted September 19 and was cut for silage; hence the following tables include only 6 crops of corn.

TABLE 1.—Plan of fertilizing, Trumbull County Experiment Farm

Pounds of fertilizing material and tons of manure per acre

Plot	On corn				On oats			On wheat			
	Acid phosphate	Muriate potash	Nitrate soda	Stall manure	Acid phosphate	Muriate potash	Nitrate soda	Acid phosphate	Muriate potash	Nitrate soda	Stall manure
Basal treatment: Finely ground limestone over all, 2 tons per acre on corn											
1											
2	200				100			200			
3	200	15			100	10		200	15		
4											
5	200	15	44		100	10	22	200	15	44	
6	400*				200*			400*			
7											
8	375	80	260					375	80	260	
9				4 T.†							4 T.†
10											
11				8 T.†	100			‡	40	60	
12		40		4 T.†					40		4 T.†
13											
14				4 T.§							4 T.§
Basal treatment: Stall manure phosphated, 60 lb. acid phosphate per ton, 4 tons per acre on corn and on wheat											
15	Fine limetone, 1 ton each on corn and wheat										
16	None										
17	Fine limestone, 2 tons on wheat										
18	Coarse limestone, 4 tons on corn, alternate rotations										
19	None										
20	Quicklime, 1 ton on corn										
21	Quicklime, 1 ton on wheat										
22	None										
23	Hydrated lime, 1 ton on corn										
24	Hyrated lime, 1 ton on wheat										
25	None										
No basal treatment											
26	200			4 T.§	100			200			4 T.§
27	200				100			200			
28											
29	400*				200*			400*			

*Commercial 2-8-2.
†Manure phosphated, 60 lb. acid phosphate per ton of manure.
‡200 lb. steamed bonemeal.
§Manure untreated.

The plan of the experiment is shown in Table 1; the yields for 1920 and 1921 and for the average of the 6 years are given in Tables 2 to 5; and the results are summarized for the entire period in Table six.

For purposes of comparison the crops are valued in Table 6 at 50 cents a bushel for corn, 33⅓ cents for oats, $1.00 a bushel for wheat, $10 a ton for hay, $4 for corn stover, and $2 for straw; and fertilizing materials are rated at $4 a ton for limestone or $8 for quicklime or hydrated lime, $20 for acid phosphate, $50 for muriate of potash, $72 for nitrate of soda, and 50 cents for farm manure—this charge for manure being made to cover the cost of hauling out and spreading. These values, of course, do not correspond exactly to the market at any time and place, but they serve the purpose of a comparison.

Effect of Phosphorus.—Computed at the prices stated above the produce of Plot 28, the only one which has received no treatment, has had a total value for each 4-year period of $43.00. On the same basis the value of the produce of Plot 27, receiving 500 pounds of acid phosphate per acre, has been $63.00, giving an increase for the acid phosphate of $20.00. The same quantity of acid phosphate on Plot 2, which has had a basal treatment of limestone, shows an additional increase of $22.00 over that due to the limestone alone on Plots 1, 4, 7, 10, and 13. Plot 14 has had limestone and manure, and its value is $79.00. Plot 9 has had the same quantities of limestone and manure as Plot 14, with the addition of 480 pounds of acid phosphate mixed with the manure; and its value is $98.00, giving $19.00 as the increase due to the slightly smaller dressing of acid phosphate. Apparently, therefore, the full dressing of 500 pounds of acid phosphate has increased the average yield by about $20.00.

Effect of lime.—Plots 1, 4, 7, 10, and 13 have had a basal treatment of 2 tons of fine limestone per acre, applied when the land was being prepared for corn. Their average yield has been $73.00, or $30.00 above the yield of Plot 28. Plots 16, 19, 22, and 25 have had a basal treatment of phosphated manure, turned under for corn, and their average yield has been $75.00. When to this treatment there has been added a dressing of 2 tons of fine limestone or 1 ton of quicklime or hydrated lime, the average yield has been $91.00 when the lime was partly or all applied to corn, and $86.00 when applied to wheat, giving an increase for the liming when applied to corn of $16.00.

Manure carries some lime, and in the experiments at Wooster on unlimed land manure has made greater yields than fertilizers.

At this stage of the work lime is showing a greater effect when applied to corn than to wheat—and burnt lime is ahead of raw limestone. The experiments at Wooster, however, are indicating that

after the practice of liming has been established it makes little difference in what part of the rotation the lime is applied. And there is reason to believe that fineness of grinding is an important factor in determining the difference between the neutralizing power of the unburnt and burnt stone.

It seems probable that it will not be necessary to continue the use of lime at so large a rate as 2 tons of limestone every 4 years, for the Wooster and Strongsville experiments are showing that the effect of a thorough liming extends over a considerably longer period than 4 years. This point requires further investigation.

Meanwhile, the Trumbull County farmer should not rest until his land has had at least one dose of lime; whether this dose should be coarsely ground or finely ground limestone, or hydrated lime, will depend upon the relative cost. It is certain that it is only the finest material that produces immediate results, and if coarse material is used the quantity should be large enough to carry the amount of fine material that the land now requires.

Effect of potassium.—The combined product of 500 pounds of acid phosphate and 2 tons of limestone has been $95.00, (Plot 2). When 40 pounds of muriate of potash is added to this treatment (Plot 3) the additional yield is less than the cost of the fertilizer. Neither is there any further gain in total value when 80 pounds of muriate of potash is added to 8 tons of phosphated manure (Plots 9 and 12), thus indicating that potash is not urgently required on this soil.

Effect of nitrogen.—The addition of 110 pounds of nitrate of soda to Plot 5 has produced a small increase over the yield from acid phosphate and muriate of potash on Plot 3, thus indicating that the clover grown in this rotation is nearly keeping up a sufficient supply of nitrogen to meet present demands.

Effect of manure.—The total product from 8 tons of untreated manure is $79.00, Plot 14. If this plot is compared with the adjoining check plot we have a gain of $10 for the manure. On Plot 26, receiving 8 tons of manure and 500 pounds of acid phosphate, the total yield is $30.00 greater than that on Plot 28, receiving no treatment; while the yield of Plot 27, receiving acid phosphate only, is $20.00 greater; thus again leaving $10.00 as the effect of 8 tons of manure.

Plots 8 and 9 are calculated to receive the same quantities each of nitrogen, phosphorus, and potassium. On Plot 8 these elements are all given in chemicals, while on 9 the nitrogen, potassium, and part of the phosphorus are carried in manure. The total yield is

$8.00 greater on Plot 8; but the cost of treatment is $19.00 greater, if we charge the manure with only the cost of hauling it onto the field, so the balance, as shown in the table, is in favor of the manured land. If, however, the cost of the manure were anywhere near that of the equivalent chemicals, when purchased in acid phosphate, muriate of potash, and nitrate of soda, the balance would be in favor of the chemicals. On the other hand, if the chemicals are purchased at their cost in factory-mixed fertilizers, the balance is more decidedly in favor of manure.

The average yield of check plots 16, 19, 22, and 25 is $75.00. These plots have received 8 tons of phosphated manure as a basal dressing. If we deduct from this the yield of Plot 27, receiving practically the same quantity of acid phosphate as that used in phosphating the manure—60 pounds per ton of manure, or 480 pounds in all—we have $12.00 as the effect apparently due to the manure.

If, however, we compare Plot 9 with Plot 2 we have but $3.00 to the credit of the manure, and if we compare Plots 12 and 3 there is but $1.00 left for the manure. Manure is usually slower in action than chemicals, and it is probable that these discrepancies will be less conspicuous after all the crops have come fully under the effect of the manure.

Considered in connection with the low effect of muriate of potash and nitrate of soda, salts which have proved their superiority to manure as carriers of potassium and nitrogen, and with the large effect of acid phosphate and carriers of lime, it would seem that the chief service of manure on this soil is to furnish phosphorus and lime.

In this respect the outcome on the Trumbull County Experiment Farm is following closely after the results attained at Strongsville, Cuyahoga County, where the total increase from 8 tons of untreated yard manure has been worth less than that from 320 pounds of 14-percent acid phosphate, as a 24-year average. (See Ohio Agr. Exp. Sta. Bul. 336, p. 649).

Both farms are located on the same general soil type, the Trumbull series. The Strongsville experiments have shown that with thorough drainage and liberal use of lime and phosphorus in systematic crop rotations these soils may be brought up to fairly satisfactory yields.

Factory-mixed vs. home-mixed fertilizers.—The 1,000 pounds of commercial 2-8-2 used on Plots 29 and 6 should carry the same quantity of phosphoric acid as 500 pounds of 16 percent acid phos-

phate, as much nitrogen as 110 pounds of nitrate of soda, and as much potash as 40 pounds of muriate of potash. That is, the applications on these plots carry the same total quantities of fertilizing elements as that on Plot 5. The cost of the factory mixture, however, at $26.00 a ton, would be $13.00 for the dressings on Plots 29 and 6, as against $10.00 for that on Plot 5. The produce on Plot 6 is $5.00 less than that on Plot 5, and that of Plot 29 is only $5.00 greater than that of acid phosphate alone on Plot 28. This leaves a balance of $3.00 in favor of the plain acid phosphate.

Financial outcome.—The experiments at Wooster and Strongsville have shown that the effect of liming, fertilizing, and manuring on the soils of northeastern Ohio may be expected to increase with persistence in the practice; and that a computation of the financial outcome of such work made at this early date is likely to fall below what may reasonably be expected later, although there will be changes in minor details as the work progresses and natural soil inequalities are to some extent eliminated.

The balances given in Table 6 are the difference between total value of increase and cost of fertilizer. No attempt is made to compute the extra cost of harvesting the increase. It costs no more to prepare the land and plant and cultivate the crop for a large yield than for a small one, but it may cost more to harvest the larger crop.

Computed in this way, the largest balance has followed the combination of limestone and acid phosphate, Plot 2, and of limestone, acid phosphate, and muriate of potash, Plot 3. Other treatments have given larger yields, but the increased cost of the treatment leaves a smaller balance.

The treatment of Plot 11 in this test is similar to that of the 40-acre Variety Field at Wooster, although not quite so liberal. The comparative treatment and outcome in those two tests is shown in Table 7, the rotations being the same—corn, oats, wheat, and clover—and the corn receiving 2 tons per acre of fine limestone in each test.

PRACTICAL APPLICATIONS

The average yields of the unlimed, unmanured, and unfertilized land for the 6 years during which this experiment has been running have been 17 bushels of corn, 33 bushels of oats, and 12.6 bushels of wheat per acre. Limestone, at the rate of 2 tons per rotation, equivalent to half a ton per acre for every crop grown, including both grain and hay, and 16 percent acid phosphate, equivalent to 125 pounds on every crop, have together increased the

yields to 37 bushels of corn, 51 bushels of oats, and 34.2 bushels of wheat. The same quantities of limestone and acid phosphate, reinforced with 2 tons of manure for every crop, have raised the yields of corn and oats to 46 bushels and 52 bushels, respectively, followed by 31.5 bushels of wheat.

During the same 6 years the average yields for Trumbull County as a whole, as shown by the statistics collected by the township assessors, have been 30 bushels of corn, 38 bushels of oats, and 18 bushels of wheat per acre—grown upon a total of about 60,000 acres in the grain crops with about the same area in hay crops.

The statistics show that in 1918 the farmers of Trumbull County purchased 4,187 tons of commercial fertilizers, of which about two-thirds was acid phosphate, and that they used nearly 188,000 loads of manure and 9,000 tons of lime. Estimating the manure at 180,000 tons, this would give a ton and a half of manure and about 70 pounds of fertilizer for each acre in grain and hay, but it would give only 1 ton of lime to 13 acres. Probably ground limestone and hydrated lime were both reported as lime, but in any case the amount used is far below the pressing need of Trumbull County soil, as is also that of acid phosphate.

Much of the soil in Trumbull County is as urgently in need of drainage as of liming or fertilizing, and the experiments in Clermont County are showing that the full effect of liming, manuring, and fertilizing cannot be attained on soggy land.

The Trumbull County Experiment Farm is showing that when drained the soil of that county is ready to respond promptly and profitably to a progressive system of agriculture, including systematic crop rotation and the liberal use of lime, phosphorus, and manure.

TABLE 2.—Fertilizers, lime, and manure on CORN, in rotation with oats, wheat, and clover, Trumbull County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on corn (See basal treatment, Table 1)	1920—Block D				1921—Block C				6-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	
No.		*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*No.*
1	None	27.57	1,300			23.86	1,800			30.75	1,808			1
2	Acid phosphate, 200 lb	40.71	2,000	10.85	633	35.86	1,950	10.33	250	37.42	2,083	6.29	297	2
4	Acid phosphate, 200 lb.; muriate potash, 15 lb	47.14	2,500	15.00	1,067	36.71	2,050	9.52	450	39.46	2,183	7.96	419	3
4	None	34.43	1,500			28.86	1,500			31.88	1,742			4
5	Acid phos., 200 lb.; mur. pot., 15 lb.; nitrate soda, 44 lb.	49.14	2,500	15.23	833	33.14	1,800	6.14	317	38.12	2,108	6.77	336	5
6	Commercial 2-8-2, 400 lb	45.29	2,250	11.91	417	30.00	1,600	4.85	133	36.91	1,958	6.10	155	6
7	None	32.86	2,000			23.29	1,450			30.26	1,833			7
8	Acid phos., 375 lb.; mur. pot., 80 lb.; nitrate soda, 260 lb.	57.29	2,550	22.57	383	36.29	1,820	11.91	303	44.14	2,378	12.36	445	8
9	Stall manure, phosphated, 4 tons	61.86	2,700	25.29	367	38.14	1,900	12.66	317	46.19	2,392	12.90	358	9
10	None	38.43	2,500			26.57	1,650			34.81	2,133			10
11	Stall manure, phosphated, 8 tons	67.14	2,800	28.00	550	48.00	2,150	22.29	570	50.58	2,558	16.68	517	11
12	Stall manure, phosphated, 4 tons; mur. potash, 40 lb.	61.29	2,700	21.43	700	41.14	1,880	16.28	370	46.37	2,305	13.37	356	12
13	None	40.57	1,750			24.00	1 440			32.09	1,857			13
14	Stall manure, untreated, 4 tons	52.57	2,450	12.00	700	32.43	1,580	8.43	140	37.37	2,022	5.27	165	14
	Average of checks 1, 4, 7, 10, 13	34.77	1,810			25.32	1,568			31.96	1,875			
15	Limestone fine, 1 ton	61.14	2,850	21.00	500	44.00	1,850	12.00	420	43.57	2,457	8.14	320	15
16	None	40.14	2,350			32.00	1,430			35.43	2,137			16
17	(Limestone on wheat)	49.57	1,700	3.95	−867	42.57	1,700	9.52	330	40.05	1,944	3.60	−148	17
18	Coarse limestone, 4 tons*	61.86	2,950	10.77	167	43.00	1,590	8.91	280	41.53	2,218	4.07	171	18
19	None	56.57	3,000			35.14	1,250			38.49	2,003			19
20	Caustic lime, 1 ton	57.14	2,000	5.38	−500	39.14	1,550	6.76	300	41.89	2,147	5.62	231	20
21	(Caustic lime on wheat)	54.57	3,000	7.62	1,000	41.86	1,720	12.24	470	40.00	2,328	5.95	499	21
22	None	42.14	1,500			26.86	1,250			31.83	1,742			22
23	Hydrated lime, 1 ton	49.86	1,900	4.43	133	42.57	1,950	11.35	583	41.26	2,133	8.37	314	23
24	(Hydrated lime on wheat)	49.14	2,100	.43	67	43.00	1,850	7.38	367	37.31	2,147	3.37	250	24
25	None	52.00	2,300			40.00	1,600			34.99	1,975			25
	Average of checks, 16, 19, 22, 25	47.71	2,287			33.50	1,382			35.18	1,964			
26	Untreated manure, 4 tons; acid phosphate, 200	40.00	1,200	21.71	200	39.86	1,500	17.57	320	32.39	1,637	15.40	400	26
27	Acid phosphate, 200 lb	22.00	1,700	3.71	700	28.71	1,330	6.42	150	26.14	1,688	9.15	452	27
28	None	18.29	1,000			22.29	1,180			16.99	1,237			28
29	Commercial 2-8-2, 400 lb	17.86	980	−.43	−20	29.29	1,300	7.00	120	26.60	1,498	9.60	262	29

*On corn, alternate rotations.

TABLE 3.—Fertilizers, lime, and manure on OATS in rotation with corn, wheat, and clover, Trumbull County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on oats (See basal treatment, Table 1)	1920—Block A				1921—Block D				6-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	
No.		*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*No.*
1	None	58.28	1,935			25.31	490			44.01	2,368			1
2	Acid phosphate, 100 lb	77.50	920	14.79	—740	26.56	650	1.35	—77	51.35	1,965	6.99	—350	2
3	Acid phosphate, 100 lb.; muriate potash, 10 lb	71.25	1,820	4.12	435	35.94	1,150	10.84	187	53.38	2,450	8.67	189	3
4	None	71.56	1,110			25.00	1,200			45.08	2,207			4
5	Acid phos., 100 lb.; mur. potash, 10 lb.; nitrate soda, 22 lb.	77.34	2,225	6.98	843	37.50	400	10.94	—650	55.65	2,152	10.52	10	5
6	Commercial 2-8-2, 200 lb	78.75	1,180	9.58	—473	30.62	920	2.49	20	52.68	1,947	7.50	—129	6
7	None	67.97	1,925			29.69	750			45.23	2,011			7
8	(Fertilizer only on corn and wheat)	75.94	1,220	8.18	—328	35.94	950	6.56	223	50.03	2,166	5.12	211	8
9	(Phosphated manure on corn and wheat)	81.72	2,355	14.17	1,185	30.62	720	1.56	17	52.44	2,317	7.87	418	9
10	None	67.34	795			28.75	680			44.24	1,842			10
11	Acid phosphate, 100 lb. (phosphated manure on corn)	81.25	2,400	13.86	1,173	32.50	960	4.17	283	56.69	2,427	12.82	448	11
12	(Phosphated manure on corn and wheat)	73.59	1,445	6.14	—213	30.62	670	2.70	—3	51.04	2,325	7 52	209	12
13	None	67.50	2,090			27.50	670			43.15	2,252			13
14	(Untreated manure on corn and wheat)	68.28	1,065	.78	—1,025	28.12	900	.62	230	43.44	2,202	.28	—51	14
	Average yield of checks 1, 4, 7, 10, 13	66.53	1,571			27.25	758			44.34	2,136			
15	(Fine limestone on corn)	62.50	2,100	.31	840	23.44	350	—5.62	—320	46.20	2,238	1.27	176	15
16	None	62.19	1,260			29.06	670			44.92	2,062			16
17	(Fine limestone on wheat)	65.31	2,210	2.76	712	30.31	730	1.15	13	47.75	2,430	3.21	275	17
18	(Coarse limestone on corn)	68.28	1,015	5.36	—722	33.12	1 190	3.85	427	45.49	2,286	1.33	38	18
19	None	63.28	1,975			29.37	810			43.77	2,341			19
20	(Caustic lime on corn)	67.97	1,475	6.93	—138	24.69	510	—2.29	—243	45.94	2,063	3.40	—106	20
21	(Caustic lime on wheat)	62.81	1,990	4.01	740	23.12	710	—1.46	13	43.49	2,211	2.20	213	21
22	None	56.56	890			22.19	640			40.05	1,827			22
23	(Hydrated lime on corn)	67.03	2,055	7.97	862	20.00	960	—.83	393	46.24	2,245	5.64	327	23
24	(Hydrated lime on wheat)	55.94	1,160	—5.62	—437	22.50	580	3.02	87	42.46	1,799	1.32	—209	24
25	None	64.06	1,800			18.12	420			41.69	2,099			25
	Average yield of checks 16, 19, 22, 25	61.52	1,481			24.68	635			42.61	2,082			
26	Acid phos., 100 lb. (untreated manure on corn and wheat)	59.37	1,050	14.21	345	20 00	960	14.06	850	44.55	2,045	11.33	267	26
27	Acid phosphate, 100 lb	66.25	1,980	21.09	1,275	10.00	380	4.06	270	42.32	2,083	9.09	305	27
28	None	45.16	705			5.94	110			33.23	1,778			28
29	Commercial 2-8-2, 200 lb	57.50	1,840	12.34	1,135	7.50	160	1.56	50	40.90	2,140	7.67	362	29

TABLE 4.—Fertilizers, lime, and manure on WHEAT in rotation with corn, oats, and clover, Trumbull County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre on wheat (See basal treatment, Table 1)	1920—Block B				1921—Block A				6-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	
No.		*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*No.*
1	None	13.75	1,125	.....	.....	17.83	1,630	.....	.....	21.65	2,117	.....	.....	1
2	Acid phosphate, 200 lb	33.50	2,240	17.42	1,072	23.83	2,370	5.50	603	34.18	2,899	11.70	709	2
3	Acid phosphate, 200 lb.; muriate potash, 15 lb	35.83	2,900	17.41	1,688	23.33	2,100	4.50	197	35.22	3,078	11.91	816	3
4	None	20.75	1,255	.....	.....	19.33	2,040	.....	.....	24.14	2,335	.....	.....	4
5	Acid phos., 200 lb.; mur. potash, 15 lb.; nitrate soda, 44 lb.	34.42	3,185	14.48	1,882	25.83	2,000	6.94	50	35.53	3,260	11.95	1,003	5
6	Commercial 2-8-2, 400 lb	29.42	2,635	10.28	1,283	25.33	2,580	6.89	720	32.53	3,040	9.52	862	6
7	None	18.33	1,400	.....	.....	18.00	1,770	.....	.....	22.44	2,100	.....	.....	7
8	Acid phos , 375 lb.; mur. potash, 80 lb.; nit. soda, 260 lb.	33.67	3,180	15.06	1,880	32.83	2,980	15.27	1,167	38.47	3,733	15.91	1,667	8
9	Stall manure, phosphated, 4 tons	25.83	2,000	6.94	800	21.67	1,500	4.56	—357	31.50	2,785	8.83	752	9
10	None	19.17	1,100	.....	.....	16.67	1,900	.....	.....	22.79	1,999	.....	.....	10
11	Acid phos., 100 lb.; steamed bonemeal, 200 lb.; mur. potash, 40 lb.; nitrate soda, 60 lb.	31.75	2,995	13.47	1,775	26.00	1,990	9.33	323	32.78	2,908	10.97	917	11
12	Stall manure phosphated	24.75	1,765	7.36	425	22.83	2,530	6.16	1,097	30.40	2,801	9.57	817	12
13	None	16.50	1,460	.....	.....	16.67	1,200	.....	.....	19.85	1,976	.....	.....	13
14	Stall manure, untreated, 4 tons	15.58	715	—.92	—745	16.67	1,700	0	500	23.67	2,547	3.82	571	14
	Average of checks 1, 4, 7, 10, 13	17.70	1,268	.....	.....	17.70	1,708	.....	.....	22.17	2,105	.....	.....	
15	(Fine limestone, 1 ton, on corn and wheat)	27.58	2,145	7.00	880	18.33	1,800	2.00	880	29.14	2,777	5.05	747	15
16	None	20.58	1,265	.....	.....	16.33	920	.....	.....	24.08	2,030	.....	.....	16
17	Fine limestone, 1 ton, on wheat	27.08	1,875	5.42	425	17.33	1,960	.72	850	26.76	2,469	1.90	283	17
18	(Coarse limestone, 4 tons, on corn, alternate rotations)	30.08	2,245	7.33	610	19.17	1,500	2.28	213	28.45	2,544	2.82	201	18
19	None	23 83	1,820	.....	.....	17.17	1,470	.....	.....	26.40	2,499	.....	.....	19
20	(Caustic lime, 1 ton, on corn)	29.75	2,315	5.25	535	21.17	1,730	4.72	500	32.15	2,985	6.51	626	20
21	Caustic lime, 1 ton, on wheat	31.17	2,480	6.01	740	16.17	1,480	.45	490	29.39	2,820	4.51	601	21
22	None	25.83	1,700	.....	.....	15.00	750	.....	.....	24.11	2,078	.....	.....	22
23	(Hydrated lime, 1 ton, on corn)	27.50	2,250	3.34	633	20.67	1,910	4.50	897	31.50	2,886	6.62	713	23
24	Hydrated lime, 1 ton on wheat	25.83	1,800	3.33	267	19.00	1,210	1.67	—67	28.36	2,423	2.70	154	24
25	None	20.83	1,450	.....	.....	18.50	1,540	.....	.....	26.43	2,364	.....	.....	25
	Average of checks 16, 19, 22, 25	22.77	1,559	.....	.....	16.75	1,170	.....	.....	25.26	2,243	.....	.....	
26	Acid phosphate, 200 lb.; untreated manure, 4 tons	24.08	1,785	18.83	1,400	17.67	1,140	8.50	590	26.86	2,314	14.26	1,185	26
27	Acid phosphate, 200 lb	13.17	1,060	7.92	675	19.83	1,610	10.66	1,060	21.83	2,094	9.23	965	27
28	None	5.25	385	.....	.....	9.17	550	.....	.....	12.60	1,129	.....	.....	28
29	Commercial 2-8-2, 400 lb	17.58	1,645	12.33	1,260	18 67	1,530	9.50	980	26.43	2,354	13.83	1,224	29

TABLE 5.—Residual effect on CLOVER, of fertilizers, lime, and manure applied to previous crops in rotation of corn, oats, wheat, and clover, Trumbull County Experiment Farm

Plot	Total treatment per acre for one rotation (See basa' treatment, Table 1)	Clover						Plot
		1920—Block C		1921—Block B		5-year average		
		Yield	Increase	Yield	Increase	Yield	Increase	
No.		*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*No.*
1	None	1,644	.....	827	.....	2,380	.....	1
2	Acid phosphate, 500 lb	2,400	445	1,413	429	3,303	864	2
3	Acid phosphate, 500 lb.; muriate potash, 40 lb.	2,133	—134	1,556	415	2,749	251	3
4	None	2,578	.....	1,298	.....	2,557	.....	4
5	Acid phosphate, 500 lb.; muriate potash, 40 lb.; nitrate soda, 110 lb	3,244	577	1,644	343	3,068	499	5
6	Commercial 2-8-2, 1,000 lb	3,333	578	1,467	163	3,047	466	6
7	None	2,844	.....	1,307	.....	2,594	.....	7
8	Acid phosphate, 750 lb.; muriate potash, 160 lb.; nitrate soda, 520 lb	4,667	1,808	1,822	432	3,740	1,173	8
9	Stall manure, phosphated, 8 tons	3,867	993	2,018	546	3,175	635	9
10	None	2,889	.....	1,556	.....	2,514	.....	10
11	Stall manure, phosphated, 8 tons; acid phos., 100 lb.; steamed bonemeal, 200 lb.; muriate potash, 40 lb.; nitrate soda, 60 lb	4,756	2,030	2,151	684	3,340	924	11
12	Stall manure, phosphated, 8 tons; muriate potash, 40 lb	4,089	1,526	1,991	613	3,301	983	12
13	None	2,400	.....	1,289	.....	2,220	.....	13
14	Stall manure, untreated, 8 ton	2,844	444	1,733	444	2,650	430	14
	Average of checks 1, 4, 7, 10, 13	2,471	.....	1,255	.....	2,453	.....	
15	Fine limestone, 1 ton each on corn and wheat	2,933	1,022	2,133	551	2,777	725	15
16	None	1,911	.....	1,582	.....	2,051	.....	16
17	Fine limestone, 2 tons on wheat	3,289	1,704	1,867	415	2,748	689	17
18	Coarse limestone, 4 tons on corn, alternate rotations	3,600	2,341	1,813	492	3,017	949	18
19	None	933	.....	1,191	.....	2,076	.....	19
20	Caustic lime, 1 ton on corn	3,111	1,970	1,902	575	2,869	803	20
21	Caustic lime, 1 ton on wheat	3,422	2,074	1,849	385	3,060	1,004	21
22	None	1,556	.....	1,600	.....	2,045	.....	22
23	Hydrated lime, 1 ton on corn	3,600	2,222	1,893	426	2,983	961	23
24	Hydrated lime, 1 ton on wheat	2,800	1,600	1,956	623	2,681	683	24
25	None	1,022	.....	1,200	.....	1,975	.....	25
	Average of checks 16, 19, 22, 25	1,355	.....	1,393	.....	2,037	.....	
26	Acid phosphate, 500 lb.; untreated manure, 8 tons	1,022	—400	1,111	435	1,642	487	26
27	Acid phosphate, 500 lb	578	—844	711	35	1,425	270	27
28	None	1,422	.....	676	.....	1,155	.....	28
29	Commercial 2-8-2, 1,000 lb	311	—1,111	524	—152	1,512	357	29

TABLE 6.—Approximate value per acre of total produce and of increase from treatment, cost of treatment, and balance, in corn-oats-wheat-clover rotation. Trumbull County Experiment Farm

Treatment	Plot numbers	Value of total produce	Value of increase	Cost of treatment	Balance
None	27	$ 43			
Acid phosphate	28	63	$20	$ 5	$15
Commercial 2-8-2	29	68	25	13	12
Limestone	1, 4, 7, 10, 13	73	30	8	22
Limestone, acid phosphate	2	95	52	13	39
Limestone, acid phosphate, muriate potash	3	96	53	14	39
Limestone, acid phosphate, mur. potash, nitrate soda	5	98	55	18	37
Limestone, commercial 2-8-2	6	93	50	21	29
Limestone, acid phosphate, mur. potash, nitrate soda	8	106	63	38	25
Limestone, manure, acid phosphate	9	98	55	17	38
Limestone, manure; bone; phosphate; potash; nitrate	11	104	61	24	37
Limestone, manure, acid phos., muriate potash	12	97	54	19	35
Limestone, manure	14	79	36	12	24
Manure, acid phosphate	16, 19, 22, 25, 26	75	32	9	23
Manure, acid phosphate, limestone (on corn and wheat)	15	90	47	17	30
Manure, acid phosphate, limestone (on wheat)	17	85	42	17	25
Manure, acid phosphate, limestone (coarse, on corn)	18	89	46	17	29
Manure, acid phosphate, quicklime (on corn)	20	92	49	17	32
Manure, acid phosphate, quicklime (on wheat)	21	89	46	17	29
Manure, acid phosphate, hydrated lime (on corn)	23	92	49	17	32
Manure, acid phosphate, hydrated lime (wheat)	24	83	40	17	23

TABLE 7.—Comparison of treatment and yields in Variety Field, Wooster, and Plot 11, Trumbull County Experiment Farm

Treatment per acre for each 4-year period	Fertilizing constituents		
	Nitrogen Lb.	Phosphoric acid Lb.	Potash Lb.
Variety Field			
Phosphated manure,* 10 tons	90	116	80
Acid phosphate and bonemeal, 300 pounds		64	
Muriate of potash, 40 pounds			20
Nitrate of soda, 60 pounds	10		
Total	100	180	100
Trumbull Farm, Plot 11			
Phosphated manure,* 8 tons	72	124	64
Acid phosphate and bonemeal, 300 pounds		66	
Muriate of potash, 40 pounds			20
Nitrate of soda, 60 pounds	10		
Total	82	190	84

Average yields per acre	Corn	Oats	Wheat	Hay
	Bu.	*Bu.*	*Bu.*	*Tons*
Variety Field, 16-year average	75	62	33	2.85
Trumbull, Plot 11, 6-year average	50	56	33	1.67

*In the Wooster test 14 percent acid phosphate has been used at the rate of 40 pounds per ton of manure, and in the Trumbull test 16 percent phosphate has been used at the rate of 60 pounds per ton of manure.

VARIETY COMPARISONS AND CULTURAL WORK

DEPARTMENT OF AGRONOMY

CORN

Fifteen varieties of corn have been tested for a period of 5 years in most cases. Table 8. The yields are reported in ear corn at husking time which gives a certain advantage to the late-maturing sorts. None of these varieties, however, can be regarded as too late for this section of the State, although more sound corn will be secured by growing the earlier sorts. The highest yielding variety is Leaming (Frost), seed of which was secured from Lake County. A strain of Reid's grown at Wooster, known as "Ohio 84", is second; Medina Pride from Medina County, third; a strain of Clarage from Wooster fourth; and a local variety, Van Wye's Yellow, fifth.

A silage test of varieties is reported in Table 9. The southern grown ensilage varieties—Eureka, Old Virginia, and Blue Ridge—have given the highest tonnage. The earlier sorts like Leaming and Clarage, although not yielding as many tons per acre, make a silage carrying a higher percentage of mature corn and less water than do the later varieties.

OATS

Fourteen varieties of oats and one each of emmer, barley, and spring wheat have been tested for a period of 7 years, except as noted in Table 10. In the oats, Silver Mine has had the lead; Big Four is second, and Golden Rain third. Barley and emmer do not yield nearly so well as oats, and spring wheat is very uncertain.

WHEAT

Twelve varieties of wheat have been tested for a period of 6 years, and five varieties for 5 years—Table 11. On the average, Gladden is first with a slight lead over Valley which is second. Fulhio is third and Fultz easily fourth.

Date of seeding wheat.—On the average wheat seeded on September 22-23 has given the highest yield; September 15-18, second; and September 8-9, third. The best date for seeding varies with the season and the prevalence of Hessian fly. Our limited data, Table 12, seem to indicate that early seeding is desirable in Trumbull County, in order to get the wheat thoroughly established before freezing weather, providing there is no danger from Hessian fly infestation.

SOYBEANS

Nine varieties of soybeans have been tested; five for a 4-year period, 1915-1918, (See Ohio Agr. Exp. Sta. Bul. No. 344, Part VI, Table 94). Ebony is first in yield with 15.70 bushels; Ohio 9100, second with 14.98 bushels; and Elton, third with 13.31 bushels.

TABLE 8.—VARIETIES OF CORN, YIELD PER ACRE

Variety	1917	1918	1919	1920	1921	5-year average	
						Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Leaming (Frost)	93.44	34.28	77.46	77.92	44.44	65.51	3,582
Ohio 84 (Wooster)	94.59	34.40	75.57	69.40	49.73	64.74	2,971
Medina Pride	90.01	35.23	77.47	70.21	50.16	64.52	3,016
White Cap	83.88	29.87	69.71	73.25	52.73	61.89	3,285
Flint	53.34	26.52	66.61	58.49	41.73	49.34	2,521
Clarage (Wooster)	89.56	32.73	76.66	67.73	55.16	64.37	3,113
Van Wye's Yellow	95.37	32.15	72.34	63.16	32.72	59.15	2,424
Golden Glow	81.47	29.76	72.33	64.83	45.16	58.71	2,734
Minnesota 13	81.86	28.85	60.13	53.20	42.59	53.32	2,774
Pride of North	77.04	30.90	65.19	58.54	49.87	56.31	3,051
Stone's Calico	70.84	24.14	63.80	57.02	32.92	49.74	2,049
Silver Wing	77.34	26.68	65.66	67.73	47.54	56.99	2,806
Mott's Yellow Dust	.....	23.85	66.95	62.73	.....	51.18	1,900
Stauffer's Yellow	.....	.....	70.56	63.64	41.59	58.60	2,493
Van Wye's Selected	.. ..	....	62.89	71.01	35.59	56.50	1,893

TABLE 9.—VARIETIES OF CORN FOR SILAGE, YIELD PER ACRE AND AVERAGE FOR PERIOD

Variety	1915	1916	1917	1918	1919	1920	1921	Average
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Clarage	6.04	8.29	.....	7.25	12.20	8.59	6.70	8.14
Leaming (Frost)	6.80	9.51	.....	9.45	12.04	9.24	7.30	9.05
Darke Co. Mammoth	7.87	10.07	.....	9.85	13.22	9.34	8.00	9.72
Reids Yellow Dent	7.49	9.69	.....	8.65	11.37	8.96	10.20	9.39
Old Virginia	8.95	11.82	10.15	8.70	17.17	8.39	13.60	11.25
Eureka	10.37	11.29	.....	8.80	17.08	10.81	13.30	11.94
Blue Ridge	8.80	11.12	10.70	8.30	14.67	8.44	8.56	10.08
Leaming P. D.	.....	.....	8.03	9.90	10.52	7.64	7.90	8.80
Boone Co. White	.....	.....	.....	9.71	15.29	.....	.....	.....
Virginia Horse Tooth	.....	.....	.....	4.15	4.25	.....	.....	.....
Amber Cane	.....	.....	.....	3.15	5.85	7.74	5.45	5.55

TABLE 10.—VARIETIES OF OATS AND SPRING WHEAT, YIELD PER ACRE

Variety	1920	1921	7-year average*	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Ohio 7009	51.04	11.10	42.01	1,220
Burt	62.76	12.56	47.68	1,691
Miami (Ohio 6203)	82.21	12.45	51.37	1,938
Ohio 201	76.79	14.43	48.79	2,606
Big Four	85.79	18.39	53.12	2,169
Ohio 6222	82.04	12.04	48.99	2,256
Silver Mine	88.33	15.27	54.02	2,205
Swedish Select	80.79	12.46	49.15	2,290
Storm King	74.76	11.52	46.31	2,266
Jeanette	80.21	19.85	51.76	1,929
Golden Rain	87.03	16.32	52.97	2,331
White Russian	69.27	14.64	46.28	2,209
Wideawake	78.23	14.33	48.06	2,414
Corn Belt	79.75	11.20	49.69	2,219†
Oderbrucker Barley	31.46	5.62	21.69	1,727
Emmer	34.84	5.31	24.83	1,921
Spring Wheat, Blue Ribbon	9 08	2.50	13.72	1,893†

*For the annual yield from 1915 to 1919 in Ohio Agr. Exp. Sta., Bul. 344, Part 6.
†6-year average.

TABLE 11.—VARIETIES OF WHEAT, YIELD PER ACRE

Variety	1920	1921	6-year average*	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Velvet Chaff	20.68	19.96	27.09	2,623
Fultz	26.10	23.52	31.51	2,460
Trumbull	24.43	23.57	30.21	2,499
Poole	15.60	22.79	27.73	2,506
Ohio 9920	21.82	20.52	30.36	2,381
Portage	31.62	22.56	30.61	2,414
Red Wave	21.54	.....	30.74	2,785
Fultzo-Mediterranean	21.23	22.85	28.84	2,418
Dawsons Golden Chaff	19.84	24.79	30.33	2,742
American Bronze	23.76	23.79	30.34	2,906
Nigger	18.26	22.07	25.78	2,034†
Gladden	24.18	22.34	32.76	3,017
Mediterranean	26.01	24.51	26.07	2,107†
Goens	25.18	.....	28.76	2,208†
Valley	30.76	19 63	32.56	2,690
Fulhio (Ohio 127)	21.43	23.95	32.33	2,725†
Red Wonder	20.01	22.46	28.10	2,205†

*The yields for the years prior to 1920 are given in Ohio Agr. Exp. Sta., Bul. 344, Part 6. †5-year average.

TABLE 12.—DATE OF SEEDING WHEAT, YIELD PER ACRE

Date of seeding	1916	1917	1919	1920	1921	Average	
						Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
September 1-3	22.00	50.00	34.67	14.66	.....	30 33	3,062
September 8-9	19.87	48.67	36.05	19.83	.....	31.10	2,840
September 15-18	20.33	45.47	36.33	25.00	.....	31.78	3,050
September 22-23	23.33	47.67	38.67	22.83	.....	33.12	3,203
October 1-2	15.17	37.50	36.33	30.33	17.00	27.27	2,529
October 7-10	4.17	18.67	32.00	16.67	20.67	18.44	1,785
October 15-21	.....	8.50	.....	9.00	23.33	13.61	1,950
October 26	.....	.....	.....	.....	23.67	.....	.....
November 5	.....	.....	.....	.....	23.67	.....	.....

BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 361 JUNE, 1922

COUNTY EXPERIMENT FARMS IN OHIO

PART VII

THE MAHONING COUNTY EXPERIMENT FARM

SIXTH AND SEVENTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

C. W. MONTGOMERY, CHIEF OF DEPARTMENT

J. P. MARKLEY, SUPERINTENDENT
McKINLEY NEWTON, FARM FOREMAN
W. A. CHUBB, HORTICULTURAL FOREMAN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$28,000.00	$28,000.00
Permanent improvements to March 1, 1920 and 1921	8,319.52	8,909.90
Permanent improvements made during year ended		
March 1, 1921: Fences, $126.21; well, $319.55; scales, barn No. 2, $107.80; cinder drive, house No. 3, $36.82—total	590.38	
March 1, 1922: Inclosed porch, house No. 3, $55.07; drainage, $309.28; fences, $53.58; plantings, $41.57—total		459.50
Total permanent investment	$36,909.90	$37,369.40
Operating equipment:		
Livestock:		
March 1, 1921: 5 horses, $700; 30 cattle, $1,580—total	$ 2,280.00	
March 1, 1922: 5 horses, $635; 3 cattle, $140—total		$ 775.00
Marchinery, tools, and harness	3,949.00	3,109.00
Crops and feed:		
March 1, 1921: corn, $120; oats, $285; potatoes, $80; straw, $120; hay, $351; wheat, $10; silage, $532; mill feed, $27.30; soyhay, $12; rye, $6—total	1,543.30	
March 1, 1922: corn, $156; oats, $225; hay, $132; straw, $120; potatoes, $150; stover, $24; clover seed, $10—total		817.00
Drain tile		216.00
Containers	51.00	45.00
Plot fixtures	187.00	172.00
Fence posts	65.50	62.50
Fertilizer (Including lime 1921)	60.00	8.00
Office equipment	30.00	25.00
Bedroom equipment	30.00	25.00
Sundries	12.00	34.00
Total operating equipment	$ 8,207.80	$ 5,288.50
Total investment	45,117.70	42,657.90

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$ 1,963.37	$ 2,000.50
From Farm sales:		
Livestock and products:		
1920—Cattle	2,103.40	
1921—Cattle, $1,382.94; calves, $20—total		1,402.94
Crops:		
1920—Corn, $102.40; oats, $28.45; wheat, 75 cents; potatoes, $3; hay, $61.87; straw, $9; apples, $292.47; sweet corn, $208.59; tomatoes, $264.25; cabbage, $326.06; cucumbers, $54.05; strawberries, $297.43; grapes, $28.05; peaches, $236.40; pasture, $196—total	$ 2,108.77	
1921—Corn, $270.43; oats, $325.30; wheat, $353.71; hay, $171; straw, $450.87; stover, $26; silage corn, $152.50; apples, $9.60; potatoes, $25.50; turnips, $2.45; sweet corn, $70.30; tomatoes, $144.92; cabbage, $331.53; cucumbers, $25.30; strawberries, $30.54; peaches, $73.60; grapes, $25.50; peppers, $6.60—total		$ 2,495.65
House rent	120.00	40.00
Logs	40.00	14.54
Sundries	6.67	7.50
Total receipts	$ 6,342.21	$ 5,961.13
Balance brought forward	2,373.67	507.47
	$ 8,715.88	$ 6,468.60

Cr.

By Expenditures

For labor	$ 4,120.47	$ 3,969.34
For current expenses*	2,212.40	1,803.05
For permanent improvements:		
1920—Fencing, $126.21; water supply, $319.55; scales, $55.85—total	501.61	
1921—Cinders and gravel for drive, $37.24; concrete work, $6.77; fence, $15.72; drainage, $169.70; plantings, $15.25; sawing lumber, $33.89—total.		278.57
For machinery and tools	28.77	38.95
For livestock: Cattle	1,243.66	
Harness	101.50	
Total	$ 8,208.41	$ 6,089.91
Balance forward	507.47	378.69
	$ 8,715.88	$ 6,468.60

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of farm in acres	1920	1921
Farmstead	7.90	7.90
Cultivated	116.25	117.07
Permanent pasture	90.55	90.55
Orchard	18.50	18.50
Woodlot	19.35	19.35
Public roads	3.95	3.95
Farm roads	8.27	8.27
Waste	13.24	12.44
Railroad	6.27	6.27
Total area of farm	284.3	284.3

Plot Work

	1920			1921		
	No. of plots	Acres	Yield per acre	No. of plots	Acres	Yield per acre
Corn	49	4.9	49.6 bu.	63	6.3	70.1 bu.
Corn silage	14	1.4	7.2 tons	.....	.....	.....
Oats	57	5.7	55.1 bu.	54	5.4	41.3 bu.
Wheat	66	6.6	4.8 bu.	66	6.6	18.5 bu.
Clover	61	6.1	1.9 tons	31	3.1	1.2 tons
Soyhay	10	1.0	1.1 tons	10	1.0	1.9 tons
Pea and oat silage	1	.1	4.0 tons	1	.1	1.5 tons
Barley	.....	.....	.....	1	.1	28.9 bu.
Emmer	.....	.....	.....	1	.1	31.2 bu.
Spring wheat	.....	.....	.....	1	.1	22. bu.
Cabbage	32	.8	5.6 tons	32	.8	4.9 tons
Cucumbers	32	.8	1.6 tons	32	.8	1.7 tons
Sweet corn	32	.8	2.1 tons	32	.8	4.1 tons
Tomatoes	32	.8	7.9 tons	32	.8	4.6 tons
Potatoes	10	.5	39.6 bu.	10	.5	63.2 bu.
Strawberries	30	1.5	60.9 bu.	30	1.5	11.6 bu.
Totals	426	31.0		396	28.0	
Double cropped	.....	.5		.....	.5	
	.....	30.5		.....	27.5	

Field Crops

Corn	.....	4.00	38.5 bu.	.....	17.07	31.1 bu.
Corn silage	.....	10.00	7.6 tons	.....	.....	.....
Oats	.....	29.00	32.1 bu.	.....	19.97	44.7 bu.
Wheat	.....	11.50	4.6 bu.	.....	15.20	18.0 bu.
Clover	.....	15.50	2.4 tons	.....	29.04	.9 ton
Timothy	.....	.....	.....	.....	1.50	1.3 tons
Soyhay (not harvested)	.....	.40	.....	.....	.....	.....
Potatoes	.....	5.00	17. bu.	.....	3.27	37.0 bu.
Alfalfa	.....	.85	1.2 tons	.....	1.00	3.1 tons
Cabbage	.....	1.33	7.1 tons	.....	.53	6.9 tons
Sweet corn	.....	1.48	1.4 tons	.....	.63	1.6 tons
Tomatoes	.....	.53	7.6 tons	.....	.40	8.8 tons
Rye	.....	.93	19.7 bu.	.....	.33	25.7 bu.
Strawberries (plants)	.....	.05	.....	.....	.05	.....
Peppers	.....	.....	.....	.....	.08	1.5 tons
Turnips	.....	.....	.....	.....	.60	13.3 bu.
Grapes	.....	.....	.....	.....	.75	1,026.0 lb.
Farm roads cultivated	.....	5.18	.....	.....	1.14	.....
Totals	.....	85.75		.....	91.56	
Double cropped	.....	.....		.....	2.	
	.....	.....		.....	89.56	

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

		Corn	Corn silage	Oats	Wheat	Clover	Soyhay
		Bu.	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*
Highest	1820	82.5	10.8	76.5	15.8	3.3	1 3
	1921	87 7	19.8	56.5	29.1	2.4	2.8
Lowest	1920	27 3	2.7	26.7	.6	1.0	.9
	1921	50.3	8.4	26.2	8.5	1.1	1.2

		Cabbage	Cucumbers	Sweet corn	Tomatoes	Potatoes	Strawberries
		Tons	*Tons*	*Tons*	*Tons*	*Bu.*	*Quarts*
Highest	1920	9.0	3.9	3.4	13.2	61.6	4,130
	1921	8.0	4.3	5.8	6.1	75.0	585
Lowest	1920	2.1	.1	.7	3.4	27.1	140
	1921	1.4	.02	1.5	2.5	52.0	190

LABOR

	1920	1921
Number of work horses	5	6
Crop acres per work horse	22.7	19.9
Man-hours for year beginning March 1	12,589	12,281
Horse-hours for year beginning March 1	5,169	5,111
Tractor-hours for year beginning March 1	323	330

*ITEMIZED CURRENT EXPENSES

	1920	1921		1920	1921
Seeds	$228.85	$128.00	Water supply main.	$ 5.35	$ 30.63
Fertilizer	342.68	209.95	Implement repairs	289.64	252.09
Spray material	26.89	20.22	Engine maintenance	502.97*	9.75
Containers	176.49	95.03	Gasoline and oil		375.30
Binder twine	46.65	35.60	Fence maintenance		6.15
Plot fixtures	33.00	5.59	Machinery hire		209.00
Feed	221.90	100.30	Transportation	33.75	
Horse shoeing	40.60	38.60	Communication	68.84	58.90
Livestock equipment	74.14	6.02	Publicity	4.51	5.31
Veterinary services	12.00	11.82	Office supplies	6.75	8.42
Livestock incidentals	4.90		Miscellaneous hdw.	26.22	4.07
Building maintenance	40.37	167.30	Market stall rent	25.00	25.00
			Total	$2,212.40	$1,803.05

*Including oil and gasoline.

REPORT OF WORK FOR THE YEARS 1920 AND 1921

J. P. MARKLEY

CLIMATIC CONDITIONS

The winter of 1919-20 was cold and the ground was covered with snow throughout the early part of the season. In January a heavy rain melted a part of the snow and then froze into a heavy ice sheet which covered the fields for about six weeks, practically destroying the wheat. April was wet and cold, there being about six inches of rainfall during the month. This, followed by a dry May, made it difficult to get the fields in proper mechanical condition for planting. The rainfall in June, July, and August was heavy. The first heavy frost, October 6, did little damage to corn and potatoes, which were practically all matured at the time. The winter of 1920-21 was very mild, with less than 15 inches of snowfall.

The summer of 1921 was a good growing season with a normal amount of rainfall well distributed throughout the season. A heavy hail storm in July did considerable damage to the corn and oats crops and to fruit. A late fall allowed the corn to mature and the wheat to get a good start.

EXPERIMENTAL WORK

No changes were made in the experimental work other than a change in the plan of orchard fertilization.

Some of the silage corn plots were cut, weighed, and shocked, October 10, and allowed to remain in the field until husking time, October 25, and reweighed, with the following results:

Variety	Pounds at silage stage	Pounds at husking time	Pounds shrinkage	Percent shrinkage
Old Virginia	2,855	1,636	1,219	42.6
Eureka	2,720	1,851	869	31.9
Clarage	2,320	1,368	952	41.0

When corn is put in the silo from the shock or when nearly dry a large amount of water must be added to make up for this loss and to ensure ensilage of the best quality.

SEED SELECTION

In 1919 a 3-year rotation of potatoes, oats, and corn, to be devoted to seed improvement, was started on a field of three acres. The Clarage variety, procured from a U. S. Department of Agriculture selection as developed in Delaware County, Ohio, was used. The first year this corn was too late for this section of the State, but by selecting early-maturing ears for seed the crop of 1920

matured fairly well. Again the early-maturing ears were selected, and in 1921 the corn grown from this seed matured as early as local varieties. This corn was husked from the standing stalks in 1921 and yielded 98.1 bushels per acre. Seed was selected in the field at about the time the first ears were mature.

FIELD WORK

Corn.—A good crop of corn was grown in 1920. About 10 acres was of the Leaming variety and was cut for silage, yielding 7.6 tons per acre. The remainder, which was of the Van Wye variety, was husked from the standing stalks.

In 1921, 7.5 acres of a 15.8 acre field was planted to Old Virginia silage corn, with the intention of feeding it to steers through the winter of 1921-1922. Later this plan was abandoned and the corn on 4.5 acres sold for silage and on 3 acres traded for field corn. The estimated yield of silage was 12 tons per acre. The remaining 8.3 acres, planted to a local variety of yellow dent corn, was husked from the standing stalks, and yielded 55¾ bushels of well-matured corn per acre.

Potatoes.—About 3 acres of Carman potatoes was planted. Both years the stand was poor and the yield low, but the quality was good, except for some scab in 1921.

Oats.—In 1920 one field of oats was sowed March 31. This seeding was followed almost immediately by a month of cold wet weather and it was three weeks before these oats were more than well sprouted. However, this field yielded better than a second field seeded May 5 and 6.

The field oats in 1921 were seeded early in April and this seeding was followed by unfavorable weather, so the yield of about 50 bushels per acre was less than the yield of oats sown later.

Wheat in 1920 was injured by the ice which covered the fields for six weeks late in the winter. The wet weather in July and August delayed threshing and caused the grain to grow in the shock, so that the wheat when marketed scarcely paid the cost of harvesting. The yield in 1921 was about an average, but the quality was poor.

Clover was a good crop in 1920. In 1921 the crop was good except on one field where lack of proper drainage and lime caused complete failure.

Alfalfa was seeded in two small fields of about ½-acre each in 1919, one producing an excellent stand, while the other failed. This field was reseeded with oats in 1920, but with no better results. The one field yielded two good cuttings in 1920 and three in 1921.

ORCHARD

The orchard work was continued as started, except that fertilizer plots were laid out across the culture blocks; thus a part of each culture block is fertilized and a part unfertilized. There are four blocks in the culture orchard cared for as follows: Block 1, intercropped; Block 2, cover-cropped; Block 3, grass and mulch; Block 4, grass without mulch.

Four fertilizer plots cross these culture blocks and are treated as follows: Plot 1, 160 pounds nitrate of soda and 200 pounds of acid phosphate per acre annually, applied evenly over the entire surface, with an additional ½-pound of nitrate of soda to each tree, applied in a circle under the outer branches; the quantity of nitrate per individual tree to be increased at the rate of ¼-pound each year until the standard quantity of 5 pounds per tree is reached; Plot 2, no fertilizer; Plot 3, 200 pounds of acid phosphate per acre, applied evenly over entire surface; Plot 4, the same as Plot 1, with acid phosphate omitted.

The young orchard produced a few apples in 1920 and a good crop in 1921, especially of the Jonathans. There was a good crop of peaches in 1920, but the crop of 1921 was damaged by late frost and later by hail, resulting in a light yield of poor fruit.

VINEYARD

A total of 325 pounds of grapes was harvested from the young vineyard of about 360 vines. The Lucile gave the highest yield of the 25 varieties and ripened a few days later than Niagara, the next highest. The grapes were killed by the May frost in 1921. However, new shoots put out, yielding a light crop. The hail injured the quality of this crop.

MARKETING

The truck crops were marketed largely in Youngstown as in former years. The smaller varieties of cabbage found a much better market than the larger sorts, such as were grown in 1919. The entire strawberry crop, which had been damaged by late frosts and by grubs, was marketed at the farm and in Canfield, though the price at Youngstown was somewhat higher. A larger percentage of the other truck crops also was marketed at the farm than in former years.

CATTLE FEEDING

Twenty head of feeding cattle were purchased on the Chicago market January 22, 1920. At first these cattle were fed a light ration of corn silage, clover hay, corn stover, and oil meal; later

cottonseed meal was fed in the place of oil meal, the feed being gradually increased until they were on full feed. They were placed on pasture, May 28, and fed a light ration of silage and clover hay for a few days. The growth of pasture was good, but the quality was poor, and after it became short, the steers were fed some green corn. They were shipped to the Pittsburgh market, December 18 and sold two days later. Following is a statement of results:

SUMMARY OF CATTLE FEEDING, JANUARY 22 to DECEMBER 18, 1920

Weight at Chicago 14,480 pounds at $10 per cwt.	$1,448.00	
Commission, buying	12.00	
Feed at yards	6.00	
Freight, feed, and war tax	74.71	
Unloading, 8 hours at 30c	2.40	$1,543.86
Labor for feeding period	137.36	
Horse-labor	4.15	
Truck	5.65	
Feed and straw for bedding	1,004.54	
Pasture	254.67	
Veterinary service and medicine	6.00	1,412.37
Freight to Pittsburgh	46.45	
Yardage	7.15	
Hay, 710 pounds	17.75	
Commission, selling	25.00	96.35
Total cost at Pittsburgh		$3,052.58
Value of manure	$ 363.98	
Cattle sold, 19,730 pounds at $7.50 per cwt.	1,479.75	1,843.73
Loss to farm		$1,208.85

These cattle were uneven in weight at the time of selling and although a few were of good quality others were somewhat rough in appearance.

Another lot of twenty head of feeding cattle was purchased on the Chicago market, January 18, 1921. These cattle were of good quality and showed considerable Shorthorn breeding. They were started on a light ration of clover hay, corn silage, and oilmeal, the amount being gradually increased until they were on full feed. After about two weeks cottonseed meal was fed in the place of oilmeal. They were sold July 7.

SUMMARY OF CATTLE FEEDING, JANUARY 18 TO JULY 7, 1921

Weight at Chicago 12,600 pounds at $7.50 per cwt.	$ 945.00	
Commission, buying	15.00	
Insurance and notary fee	.35	
Freight and war tax	86.15	
Feed	7.20	
Unloading and feeding	1.00	$1,054.70
Hay, 17,580 pounds	$ 98.08	
Silage, 66,900 pounds	267.60	
Straw, 11,000 pounds	33.00	
Oilmeal, 400 pounds	11.00	
Cottonseed meal, 4,520 pounds	95.70	
Salt, 150 pounds	1.50	
Pasture, 46 days at $2 a head per month	61.33	
Labor, 253 hours at 36 cents an hour	90.88	$ 659.09
Total cost to farm		$1,713.79
Value of manure	193.50	
Weight 16,136 pounds at $6.50 per cwt.	1,048.84	1,242.34
Loss to farm		$ 471.45

The average gain was 209 pounds per head for the 166 days. They made very good gains until they were turned on pasture May 20, after which they gained but little.

SILO FILLING

Ten acres of Leaming corn was put into the silo October 7, 1920. The corn was well eared and nearly mature when cut. The 16-inch Papec cutter and 10-20 Titan tractor owned by the farm were used in this work, the time required being 9 hours and the total amount of labor required, including cutting and hauling ½ mile, 135 man-hours and 123 horse-hours.

COST OF FILLING SILO

Man- and horse-labor	$77.78	
Tractor and cutter, 9 hours	24.75	
Meals for silo fillers, 24	12.00	
Twine, 35 pounds at 19c	6.60	
Use of binder, 10 acres at 25c	2.50	$123.63
Value of grain, 500 bu. estimated at 90c		450.00
Total cost of silage		$573.63
Cost per ton		7.55
Number of acres	10	
Number of tons	76	
Tons per acre	7.6	
Cost of filling silo per acre	$12.36	
Cost of filling silo per ton	$ 1.63	

EQUIPMENT

The only addition to the farm equipment for the two years was a heavy set of work harness, purchased in the spring of 1920.

MEETINGS AND EXHIBITS

The annual field meeting, August 21, 1920, was not as well attended as in former years, probably due to the busy season. However, there were several hundred present from Mahoning and adjoining counties. In 1921 the annual field meeting was held late in June. Again the attendance was not large but considerable interest was shown in the experimental work, especially in the truck experiments and orchard work. The speaking program of these meetings was held at the county fair grounds, across the road from the farm.

Exhibits were made at the Mahoning County Fair each year. In 1921 the fair building was repaired, giving the farm plenty of space for a good exhibit, so that it was possible to show much of the results of the experimental work. Several varieties of field and truck crops and fruits were exhibited. Samples of grain in the sheaf, and of the truck crops, were prepared to show the results obtained from the use of different fertilizers and manure. These exhibits have brought many visitors to the farm.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

I. EXPERIMENTS WITH FIELD CROPS

Three rotations are in progress on the Mahoning County Experiment Farm—namely:

Rotation I: Corn, oats, wheat, and mammoth clover—the clover to be plowed under after saving the seed.

Rotation II: Corn, oats, wheat, and medium clover—all crops to be removed.

Rotation III: Corn, soybeans, wheat, and clover—all crops to be removed.

All the land in these rotations is dressed with finely-ground limestone after being plowed for corn, the limestone being applied over all the land, fertilized and unfertilized alike.

The arrangement of the land is shown in the diagram accompanying. Each rotation occupies 4 blocks of 10 plots each. The plots contain one-tenth acre each and are separated by paths 2 feet wide. The field slopes gently to the west and tile drains are laid under alternate paths. Corn was planted on Blocks C, D, G, H, L,

and M in 1916 and 1917, but it was injured by an early frost in 1916 and by wireworms in 1917 and the plots were not harvested separately.

The plan of fertilizing is shown in Table 1 and the results to 1921 are given in the tables following.

TABLE 1.—Plan of fertilizing in farm crop rotations, Mahoning County Experiment Farm

Pounds of fertilizing material per acre on each crop

Plot	On corn				On oats or soybeans			On wheat			Plot
	Acid phosphate	Muriate potash	Nitrate soda	Manure	Acid phosphate	Muriate potash	Nitrate soda	Acid phosphate	Muriate potash	Nitrate soda	
Rotation I: Corn-oats-wheat-clover. Clover plowed under.											
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
2	200	.....	.....	.....	100	.....	.....	200	.....	.....	2
3	*	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
5	**	.....	.....	.....	†	.....	.....	**	.....	.....	5
6	200	15	.....	.....	100	10	.....	200	15	.....	6
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
8	*	40	.....	.....	.....	.....	.....	.....	.....	.....	8
9	**	15	.....	.....	†	10	.....	**	15	.....	9
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
Rotation II: Corn-oats-wheat-clover. All crops removed.											
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
2	200	.....	.....	.....	100	.....	.....	200	.....	.....	2
3	200	15	.....	.....	100	10	.....	200	15	.....	3
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
5	200	15	45	.....	100	10	20	200	15	45	5
6	250	40	125	.....	.....	.....	.....	250	40	125	6
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
8	.....	.....	.....	4 tons§	.....	.....	.....	200	.....	.....	8
9	.....	.....	.....	4 tons	.....	.....	.....	.....	.....	.....	9
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
Rotation III: Corn-soybeans-wheat-clover. All crops removed.											
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
2	200	.....	.....	.....	100	.....	.....	200	.....	.....	2
3	200	15	.....	.....	100	10	.....	200	15	.....	3
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
5	200	15	45	.....	100	10	20	200	15	45	5
6	300	40	200	.....	300	40	.....	300	40	200	6
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
8	.....	.....	.....	6 tons§	180	.....	.....	300	.....	.....	8
9	200	.....	.....	10 tons§	.....	.....	.....	200‡	40	.....	9
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10

*Floats, 27 percent, 700 pounds on corn only.
**Steamed bonemeal, 120 pounds.
†Steamed bonemeal, 60 pounds.
‡Also, steamed bonemeal, 100 pounds.
§Phosphated manure—40 pounds acid phosphate per ton of manure.
(Untreated manure on Plot 9, Rotation II.)

Table 8 shows that the Mahoning soil is hungry for phosphorus, the increase from acid phosphate and steamed bonemeal being worth from 3 to 5 times the cost of the phosphate. When the phosphate is given in the raw rock, however, the increase fails to pay the cost, notwithstanding the fact that the rock has been applied in connection with the turning under of a crop of clover.

The apparent increase from potash on Plot 6, Rotation I, is probably due in part to soil variation, as it is not borne out by the similarly treated Plot 9 in that rotation, nor by Plots 2 in the other two rotations.

The value of the unfertilized yield in Rotation I is much less than that in either of the other rotations, showing that the plowing under of the clover crop has not as yet been profitable. The work must be carried further, however, before this point can be settled.

The treatment of Plot 5, in Rotations II and III, gives the same quantities of ammonia, phosphoric acid, and potash that would be carried in 1000 pounds of a 2-8-2 fertilizer. When this treatment is charged at its cost in nitrate of soda, acid phosphate, and muriate of potash it leaves a larger balance than that found from the partial treatments on Plots 2 and 3. If, however, this treatment be charged at its cost in a factory mixture of that formula the balance will be less than that from the acid phosphate alone.

On Plot 6, Rotation II, the ammonia and potash are increased to quantities equivalent to what would be found in 4 tons of manure; and on Plot 8 the manure is reinforced with acid phosphate to bring up its total phosphoric acid to that found in 500 pounds of acid phosphate. The result is a reduction in yield on Plot 6, which may be due to a soil variation, and a still greater reduction on Plot eight.

The increase from 4 tons of untreated manure on Plot 9, Rotation II, is only one-third that from 500 pounds of acid phosphate.

In Rotation III acid phosphate is added to Plot 6 in larger quantity and the total yield is increased, but the greater cost of the ammonia and potash reduces the balance. On Plot 8, six tons of manure has been used as the carrier of the ammonia and potash and a small part of the phosphorus and the total yield approaches that on Plot 6. On Plot 9 the manure is increased to 10 tons, with a corresponding increase of acid phosphate and the maximum total yield of the experiment is reached.

In the columns headed "chemical valuations" the constituents of manure are rated at the same prices as those in nitrate of soda, acid phosphate, and muriate of potash. When so valued the balance from manure is always less than that from chemicals, but such a valuation would rate manure at about $2.50 a ton.

If we charge the manure with merely the cost of moving from the stable to the field, say 50 cents a ton, we have the balance left in the last column of the table, showing that manure thus used may take the place of purchased nitrogen and potash with a great saving in cost.

PRACTICAL APPLICATIONS

The statistics of the United States Census show that in 1919 there were practically 16,000 acres each in corn, oats, and wheat in Mahoning County, with 36,000 acres in hay crops, of which 21,000 acres were in timothy alone, and 15,000 acres in clover alone or clover and timothy mixed. These figures would indicate that a fairly systematic rotation has been adopted in the county, of corn, oats, and wheat, one year each, followed by from 2 to 3 years in clover and timothy. The census statistics show that a total of $147,171 was spent during the census year for commercial fertilizers, and the statistics collected by the township assessors of the State for 1918 indicate that acid phosphate constituted about two-thirds of the total quantity of fertilizer bought in Mahoning County, and mixed fertilizers one-third. The assessors reports show a total purchase of 3,533 tons of fertilizers for 1918, but the assessors reports are practically always too low. The expenditure reported by the census would indicate a total purchase of about 4,600 tons, if the average cost of mixed fertilizers in that year of high prices were estimated at $40.00, and that of acid phosphate at $28.00 a ton. This would give about 100 pounds of fertilizer for every acre in grain and hay, as against the 125 pounds used on Plots 2, 135 pounds on Plots 3, and 162 pounds on Plots 5 in Rotations II and III on the County Experiment Farm.

The assessors reported the use in 1918 of 153,652 loads of manure in Mahoning County. The livestock reported in the county by the census would be equivalent to about 39,000 head of cattle, if 10 head of sheep or swine were estimated as equivalent to one head of cattle or horses for manure production. The census, however, included young as well as mature animals. If all under 1 year of age were deducted the total would be equivalent to about 33,000 head of mature cattle, which should produce about 83 tons of manure a day, or 150,000 tons during 6 months of winter feeding, which would give 1⅔ tons for every acre in grain and hay, or practically the same quantity used on Plot 8, Rotation III, on the experiment farm. This plot, however, receives acid phosphate at the rate of 180 pounds annually in addition to the manure; so that, in addition to the same quantity of manure and fertilizer, it is getting about 80 pounds more acid phosphate yearly than is being given to the average acre over Mahoning County.

The average yields of Plot 8 for the 4 years under review, have been 63.9 bushels of corn, 44.4 bushels of oats, and 20.7 bushels of wheat per acre. During the same 4 years the average yields for

the county have been 41 bushels of corn, 37 bushels of oats, and 14.9 bushels of wheat—a difference of 22.9 bushels of corn, 7.4 bushels of oats, and 5.8 bushels of wheat. This difference cannot all be credited to the additional fertilizer, however; for the corn on the experiment farm is grown on clover sod, whereas most of that in the county is grown on timothy sod. In the experiments at Wooster corn grown on clover sod has made a greater yield by about 6½ bushels per acre than that grown on timothy sod, as a 24-year average, the same variety of corn being grown and no fertilizer or manure being used in either case. On the Mahoning County Experiment Farm 200 pounds of acid phosphate, applied directly to the corn crop, has increased the yield by 7.7 bushels as the average of the 3 rotations, or at the rate of 3 bushels for 80 pounds of the phosphate. These two points would account for 9½ bushels of the difference in corn and for most of that in oats. Further than this, the soil of the experiment field has been limed at the rate of 2 tons of ground limestone per acre for every corn crop; whereas the 7,000 tons of lime reported by the township assessors as used in 1918 would give but half a ton per acre to each corn crop had it all been applied to corn; but the usual practice is to give the lime all to the wheat. Moreover, in the ultimate distribution this 7,000 tons has been all that the 90,000 acres in crops have received, or only 1 ton to 13 acres; whereas on the experiment farm, the 2 tons have been repeated every 4 years, thus giving the equivalent of half a ton annually.

No land was left unlimed in the Mahoning experiments; but on the Experiment Farm at Wooster the total increase from 2 tons of limestone, applied to corn on otherwise unfertilized land, has been 5.7 bushels of corn, 5.1 bushels of wheat, 3.5 bushels of oats, and 1400 pounds of hay as an 18-year average; and on the Trumbull County Experiment Farm 2 tons of limestone, applied half on corn and half on wheat in a rotation of corn, oats, wheat, and clover, has increased the yields by 8 bushels of corn, 5 bushels of wheat, and 700 pounds of hay.

It seems safe to conclude, therefore, that the superior yield of corn on Plot 8 is chiefly due to growing it on clover instead of timothy sod, to the more liberal use of acid phosphate, and to the liming.

Wheat has shown a remarkable response to acid phosphate on the Mahoning County Experiment Farm, the 5-year average increase from the direct application of 200 pounds of acid phosphate being 11 bushels of wheat, or 4.4 bushels for 80 pounds of phos-

phate. When to this is added the increase due to more systematic liming, it is easy to account for all the superiority in yield of wheat on Plot 8 over that of the county as a whole.

Still another point, however, must be taken into consideration, and that is that the land under experiment has been thoroughly underdrained; and the experiment in drainage on the Clermont County Experiment Farm is showing that, while drainage may add nothing to the yield of unfertilized land, it very greatly increases the effect of fertilizers and manures.

TABLE 2.—Fertilizers and manure on CORN, Mahoning County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot No.
Rotation I: Corn-oats-wheat-mammoth clover. Clover plowed under after saving seed. Ground limestone 2 tons per acre over all on corn.														
		Block C				Block D				4-year average				
1	None	38.14	1,900			59.79	2,500			46.53	2,010			1
2	Acid phosphate, 200 lb	39.14	2,100	1.69	233	68.36	2,700	9.12	167	51.57	2,225	5.59	227	2
3	Floats, 700 lb	41.79	2,000	5.03	167	65.00	2,700	6.31	133	49.03	2,062	3.60	76	3
4	None	36.07	1,800			58.14	2,600			44.87	1,975			4
5	Steamed bonemeal, 120 lb	41.00	2,200	4.38	500	62.29	2,600	4.48	50	50.20	2,150	5.04	241	5
6	Acid phosphate, 200 lb.; muriate potash, 15 lb	52.29	2,200	15.15	600	67.71	3,100	10.24	600	57.68	2,275	12.25	433	6
7	None	37.71	1,500			57.14	2,450			45.71	1,775			7
8	Floats, 700 lb.; muriate potash, 40 lb	44.79	2,700	8.15	1,200	63.93	2,800	9.05	367	50.34	2,347	6.79	554	8
9	Steamed bonemeal, 120 lb.; muriate potash, 15 lb	41.86	2,500	6.29	1,000	69.86	2,750	17.24	333	52.54	2,252	11.14	441	9
10	None	34.50	1,500			50.36	2,400			39.23	1,830			10
	Average unfertilized yield	36.61	1,675			56.36	2,487			44.09	1,897			
	Average fertilized yield	43.48	2,283			66.19	3,275			51.89	2,218			
Rotation II: Corn-oats-wheat-medium clover. All crops removed. Ground limestone 2 tons per acre over all on corn.														
		Block G				Block H				4-year average				
1	None	30.71	1,700			53.71	2,600			48.43	2,100			1
2	Acid phosphate, 200 lb	43.43	2,600	13.84	967	72.86	3,200	16.89	567	56.77	2,600	8.13	467	2
3	Acid phosphate, 200 lb.; muriate potash, 15 lb	46.86	2,700	18.38	1,133	75.71	3,100	17.47	433	59.80	2,562	10.95	395	3
4	None	27.36	1,500			60.50	2,700			49.05	2,200			4
5	Acid phos., 200 lb.; mur. pot., 15 lb.; nit. soda, 45 lb	47.71	2,500	17.37	1,000	71.21	3,000	9.54	467	61.21	2,675	13.25	604	5
6	Acid phos., 250 lb.; mur. pot., 40 lb.; nit. soda, 125 lb	36.07	2,000	2.76	500	80.71	4,300	17.95	1,933	58.28	2,675	11.44	733	6
7	None	36.29	1,500			63.93	2,200			45.75	1,812			7
8	Phosphated stall manure, 4 tons	51.86	3,200	13.71	1,533	84.93	3,900	16.79	1,200	63.88	2,850	16.76	875	8
9	Untreated stall manure, 4 tons	43.07	2,200	5.07	367	80.21	3,800	7.85	600	57.28	2,650	8.84	513	9
10	None	38.86	2,000			76.57	3,700			49.78	2,300			10
	Average unfertilized yield	33.30	1,675			63.68	2,800			48.25	2,103			
	Average fertilized yield	44.83	2,533			77.60	3,550			59.54	2 669			

TABLE 3.—Fertilizers and manure on OATS, Mahoning County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot No.
Rotation I: Corn-oats-wheat-mammoth clover. Clover plowed under after saving seed. Ground limestone 2 tons per acre over all on corn.														
		Block B				Block C				5-year average				
1	None	38.12	2,080			41.87	1,160			44.84	2,181			1
2	Acid phosphate, 100 lb	36.25	2,840	—4.48	577	47.81	1,670	7.08	373	50.31	2,464	5.70	274	2
3	(To have raw phosphate rock on clover sod for corn)	36.56	2,930	—6.67	483	41.25	1,480	1.67	47	43.69	2,182	—.68	36	3
4	None	45.94	2,630			38.44	1,570			44.13	2,208			4
5	Steamed bonemeal, 60 lb	39.69	2,730	—3.12	167	44.22	2,285	4.64	652	48.97	1,473	4.73	272	5
6	Acid phosphate, 100 lb.; muriate potash, 10 lb	50.00	2,400	10.31	—97	52.50	2,222	11.77	525	54.56	2,534	10.21	340	6
7	None	36.56	2,430			41.87	1,760			44.47	2,187			7
8	(To have raw phosphate rock on clover sod for corn)	38.12	3,480	2.29	827	40.94	1,190	1.05	—433	44.41	2,469	.41	164	8
9	Steamed bonemeal, 60 lb.; muriate potash, 10 lb	35.31	2,870	.21	—7	41.25	1,680	3.33	193	45.56	2,592	2.03	168	9
10	None	34.37	3,100			35.94	1,350			43.06	2,542			10
	Average unfertilized yield	38.74	2,560			39.53	1,460			44.12	2,279			
	Average fertilized yield	39.32	2,875			44.65	1,754			47.92	2,452			
Rotation II: Corn-oats-wheat-medium clover. All crops removed. Gound limestone 2 tons per acre over all on corn.														
		Block F				Block G				5-year average				
1	None	47.66	3,275			33.75	1,520			42.75	2,332			1
2	Acid phosphate, 100 lb	35.78	2,675	—14.33	—242	46.87	1,400	12.70	—43	45.62	2,416	1.80	151	2
3	Acid phosphate, 100 lb.; muriate potash, 10 lb	69.06	2,590	16.51	72	47.81	2,070	13.23	710	56.00	2,610	11.10	412	3
4	None	55.00	2,140			35.00	1,280			45.97	2,131			4
5	Acid phos., 100 lb.; mur. potash, 10 lb.; nitrate soda, 20 lb.	69.22	3,335	23.65	1,493	35.00	2,380	—2.29	1,040	56.06	2,946	11.00	809	5
6	(Fertilized on corn and wheat only)	38.75	2,710	2.60	1,167	45.62	1,540	6.04	140	47.78	2,561	3.62	417	6
7	None	26.72	1,245			41.87	1,460			43.25	2,150			7
8	(Manured and fertilized on corn and wheat only)	55.31	3,330	24.89	1,737	56.56	1,890	14.90	423	54.90	2,859	10.43	626	8
9	(Manure on corn alone)	45.94	3,030	11.83	1,088	46.25	1,820	4.79	347	49.78	2,567	4.07	252	9
10	None	37.81	2,290			41.25	1,480			46.94	2,398			10
	Average unfertilized yield	41.80	2,237			37.97	1,435			44.73	2,253			
	Average fertilized yield	52.34	2,945			46.35	1,850			51.69	2,660			

TABLE 4.—Fertilizers and manure on WHEAT, Mahoning County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot No.
Rotation I: Corn-oats-wheat-mammoth clover. Clover plowed under after saving seed. Ground limestone, 2 tons per acre over all on corn.														
		Block A				Block B				5-year average				
1	None	2.50	1,050			11.50	510			11.37	1,508			1
2	Acid phosphate, 200 lbs	1.25	725	—.83	—150	17.17	1,070	5.84	350	19.87	1,928	8.87	488	2
3	(To have raw phosphate rock on clover sod for corn)	2.33	360	.66	—340	15.00	1,600	3.83	670	11.62	1,403	.99	30	3
4	None	1.25	525			11.00	1,140			10.25	1,305			4
5	Steamed bonemeal, 120 lb	2.83	430	1.22	—73	15.17	990	3.34	—200	18.77	1,914	8.66	571	5
6	Acid phosphate, 200 lb.; muriate potash, 15 lb	7.33	1,260	5.36	778	20.67	2,360	8.00	1,120	23.32	2,431	13.35	1,048	6
7	None	2.33	460			13.50	1,290			9.82	1,421			7
8	(To have raw phosphate rock and muriate potash on clover sod for corn)	3.25	505	.59	—168	18.33	1,800	6.22	660	11.88	1,537	2.35	159	8
9	Steamed bonemeal, 120 lb.; muriate potash, 15 lb	2.33	860	—.67	—27	17.33	1,760	6.61	770	17.73	1,976	7.14	615	9
10	None	3.33	1,100			9.33	840			10.98	1,331			10
	Average unfertilized yield	2.35	784			11.33	945			10.60	1,391			
	Average fertilized yield	3.22	690			17.28	1,957			17.20	1,865			
Rotation II: Corn-oats-wheat-medium clover. All crops removed. Ground limestone, 2 tons per acre over all on corn.														
		Block E				Block F				5-year average				
1	None	3.17	1,410			15.00	1,500			11.22	1,537			1
2	Acid phosphate, 200 lb	4.25	1,845	.03	532	22.50	2,650	7.50	1,117	23.72	2,487	12.70	1,018	2
3	Acid phosphate, 200 lb.; muriate potash, 15 lb	5.17	1,590	—.11	373	22.33	2,360	7.33	793	23.98	2,601	3.15	1,201	3
4	None	6.33	1,120			15.00	1,600			10.63	1,332			4
5	Acid phos., 200 lb.; mur. potash, 15 lb.; nit. soda, 45 lb.	9.67	2,320	5.23	1,487	24.17	2,450	10.61	1,030	25.15	2,711	14.56	1,380	5
6	Acid phos., 250 lb.; mur. potash, 40 lb.; nit. soda, 125 lb.	9.17	1,250	6.61	703	25.67	2,160	13.56	920	27.35	2,589	16.81	1,258	6
7	None	.67	260			10.67	1,060			10.50	1,330			7
8	Acid phosphate, 200 lb. (To be manured on corn)	2.42	1,755	—1.22	1,107	20.00	1,900	9.94	903	20.67	2,490	9.33	1,094	8
9	(To be manured on corn)	2.92	425	—3.69	—612	13.00	1,420	3.56	487	13.00	1,860	.83	397	9
10	None	9.58	1,425			8.83	870			13.01	1,529			10
	Average unfertilized yield	4.94	1,054			12.37	1,262			11.34	1,433			
	Average fertilized yield	5.60	1,531			21.28	2,157			22.31	2,456			

TABLE 5.—Fertilizers and manure on CORN and SOYBEANS, Mahoning County Experiment Farm
Yield and increase per acre

Plot	Treatment per acre	1920				1921				Average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Stover or straw	Grain	Stover or straw	Grain	Stover or straw	Grain	Stover or straw	Grain	Stover or straw	Grain	Stover or straw	
	Rotation III: Corn-soybeans-wheat-medium clover. All crops removed. Ground limestone 2 tons per acre over all on corn.													
	Corn	Block L				Block M				4-year average				
		Bu.	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	
1	None	34.93	2,100	.....	.....	58.00	2,400	.....	.....	35.93	1,625	.....	.....	1
2	Acid phosphate, 200 lb	46.64	2,700	13.16	667	71.57	2,600	11.07	167	47.82	2,092	9.38	392	2
3	Acid phosphate, 200 lb.; muriate potash, 15 lb	44.64	2,300	12.62	333	72.36	2,600	9.36	133	52.41	2,195	11.46	420	3
4	None	30.57	1,900	.....	.....	65.50	2,500	.....	.....	43.46	1,850	.....	.....	4
5	Acid phos., 200 lb.; mur. potash, 15 lb.; nitrate soda, 45 lb.	50.36	3,000	16.43	900	72.36	3,050	8.31	617	56.80	2,512	12.73	608	5
6	Acid phos., 300 lb.; mur. potash, 40 lb.; nit. soda, 200 lb.	55.86	3,200	18.58	900	75.71	3,350	13.12	983	59.09	2,837	14.40	879	6
7	None	40.64	2,500	.....	.....	61.14	2,300	.....	.....	45.30	2,012	.....	.....	7
8	Phosphated stall manure, 6 tons	56.14	3,000	16.43	550	68.57	3,800	4.33	1,500	64.14	3,037	17.50	950	8
9	Phosphated stall manure, 10 tons	65.00	3,250	26.21	850	105.21	3,600	37.88	1,500	76.14	3,187	28.17	1,025	9
10	None	37.86	2,350	.....	.....	70.43	2,300	.....	.....	49.30	2,237	.....	.....	10
	Average unfertilized yield	36.00	2,212	.....	.....	63.77	2,375	.....	.....	43.50	1,931	.....	.....	
	Average fertilized yield	53.11	2,908	.....	.....	77.62	3,267	.....	.....	59.40	2,644	.....	.....	
	Soybeans: Total produce													
		Block K				Block L				4-year average				
		Lb.	*Lb.*			*Lb.*	*Lb.*			*Lb.*	*Lb.*			
1	None	2,000	.....			2,500	.....			2,177	.....			1
2	Acid phosphate, 100 lb	1,800	—300			3,700	1,167			2,449	197			2
3	Acid phosphate, 100 lb.; muriate potash, 10 lb	2,200	0			2,800	233			2,509	183			3
4	None	2,300	.....			2,600	.....			2,400	.....			4
5	Acid phos., 100 lb.; mur. potash, 10 lb.; nit. soda, 20 lb.	2,700	267			3,700	967			3,235	782			5
6	Acid phosphate, 300 lb.; muriate potash, 40 lb	2,300	—267			4,600	1,733			3,556	1,051			6
7	None	2,700	.....			3,000	.....			2,557	.....			7
8	Acid phosphate, 180 lb	2,600	133			5,600	2,367			3,689	1,210			8
9	(To be manured and fertilized on corn and wheat only)	3,100	867			5,600	2,133			3,636	1,236			9
10	None	2,000	.....			3,700	.....			2,321	.....			10
	Average unfertilized yield	2,250	.....			2,950	.....			2,364	.....			
	Average fertilized yield	2,450	.....			4,333	.....			3,177	.....			

TABLE 6.—Fertilizers and manure on WHEAT, Mahoning County Experiment Farm. Yield and increase per acre

Plot	Treatment per acre	1920—Block I				1921—Block K				5-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	
	Rotation III: Corn-soybeans-wheat-clover. All crops removed. Ground limestone 2 tons per acre over all on corn.													
No		*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*No.*
1	None	3.33	400	.....	.....	12.50	950	.....	.....	11.30	1,330	.....	.....	1
2	Acid phosphate, 200 lb	10.00	1,300	7.28	863	20.50	2,570	7.61	1,443	22.63	2,322	11.50	955	2
3	Acid phosphate, 200 lb.; muriate potash, 15 lb	7.17	1,670	5.06	1,197	24.33	2,240	11.05	937	22.55	2,617	11.57	1,213	3
4	None	1.50	510	.....	.....	13.67	1,480	.....	.....	10.82	1,441	.....	.....	4
5	Acid phos , 200 lb.; mur. potash, 15 lb.; nit. soda, 45 lb.	15.83	2,050	13.44	1,427	24.33	2,640	10.77	1,253	25.50	2,750	14.73	1,303	5
6	Acid phos., 300 lb.; mur. potash, 40 lb.; nit. soda, 200 lb.	15.00	1,200	11.72	463	29.17	3,650	15.73	2,357	28.30	3,032	17.59	1,578	6
6	None	4.17	850	.....	.....	13.33	1,200	.....	.....	10.67	1,460	.....	.....	7
8	Acid phosphate, 300 lb. (Manured on corn)	9.00	1,260	1.22	327	25.17	2,790	10.67	1,360	24.45	2,663	13.03	1,192	8
9	Acid phos., 200 lb.; steamed bonemeal, 100 lb.; muriate potash, 50 lb. (Phosphated manure on corn)	10.58	965	—.81	—52	27.50	3,050	11.84	1,390	24.77	2,754	12.60	1,270	9
10	None	15.00	1,100	.....	.....	16.83	1,890	.....	.....	12.92	1,495	.....	.....	10
	Average unfertilized yield	6.00	715	.....	.....	14.08	1,380	.....	.....	11.42	1,431	.....	.....	
	Average fertilized yield	11.26	1,407	.....	.....	25.17	2,823	.....	.....	24.70	2,690	.....	.....	

TABLE 7.—Residual effect on CLOVER of fertilizers applied to previous crops, Mahoning County Experiment Farm

Plot	Fertilizing materials per acre on previous crops				Yield and increase per acre					
					1920		1921		Average	
	Acid phosphate Lb.	Muriate potash Lb.	Nitrate soda Lb.	Manure Tons	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.
Rotation II: Corn-oat-wheat-clover: All crops removed.										
					Block H		Block E		5-year average	
1					2,933		2,933		2,922	
2	500				4,000	1,422	4,000	771	3,989	1,007
3	500	40			3,733	1,511	4,267	741	4,033	993
4					1,867		3,822		3,100	
5	500	40	110		4,267	1,896	4,178	771	4,122	1,122
6*	500	80	250		4,089	1,215	3,911	918	3,860	960
7					3,378		2,578		2,800	
8	360			4	4,444	948	2,489	—178	3,382	550
9				4	3,200	—415	2,400	—355	2,809	—54
10					3,733		2,844		2,895	
Average unfertilized yield					2,978		3,044		2,929	
Average fertilized yield					3,955		3,541		3,699	
Rotation III: Corn-soybeans-wheat-clover; All crops removed.										
					Block M		Block J		4-year average	
1					3,511		1,956		2,907	
2	500				3,778	460	2,933	888	3,210	339
3	500	40			4,000	874	2,756	623	3,689	854
4					2,933		2,222		2,800	
5	500	40	110		4,000	978	3,822	1,600	3,822	1,027
*6	900	120	400		4,089	978	3,733	1,511	4,066	1,277
7					3,200		2,222		2,784	
8	720			6	5,600	2,044	4,267	1,956	4,533	1,584
9	600‡	40		10	5,956	2,045	4,000	1,600	4,682	1,569
10					4,267		2,489		3,278	
Average unfertilized yield					3,478		2,222		2,942	
Average fertilized yield					4,570		3,585		4,000	

*To compare with 8.
‡And 100 pounds steamed bonemeal. (To compare with variety field, O. A. E. S.)

TABLE 8.—Total fertilizing constituents per acre for 4-year period; value of increase, and cost and balance from chemical fertilizer and manure
Mahoning County Experiment Farm

Plot No.	Fertilizing constituents				Value of increase	Cost of treatment and balance			
						Chemical valuations		Manure valuations	
	Ammonia	Phosphoric acid	Potash	Manure		Cost	Balance	Cost	Balance
	Lb.	Lb.	Lb.	Tons	Dollars	Dollars	Dollars	Dollars	Dollars
	Rotation I: Corn-oats-wheat-clover Clover plowed under.								
2	....	80	.....	.....	14.77	5.00	9.77	.....	.....
3	.....	180*	.....	.....	2.78	5.00	—2.22	.....	.....
5	2**	80	.....	.....	14.08	5.00	9.08	.....	.....
6	.....	80	20	.....	25.13	6.20	18.93	.....	.....
8	.....	180*	20	.....	7.31	6.20	1.11	.....	.....
9	2**	80**	20	.....	15.05	6.20	8.85	.....	.....
Value of average unfertilized yield					54.81				
	Rotation II: Corn-oats-wheat-clover. All crops removed.								
2	....	80	.....	.....	24.49	5.00	19.49	.....	.....
3	.....	80	20	.....	29.68	6.20	23.48	... .	.....
5	20	80	20	.....	33.86	9.50	24.36	.....	.....
6	48	80	40	.....	31.68	14.10	17.58	.....	.....
8	48	80	40	4	27.41	14.10	13.31	5.60	21.81
9	48	24	40	4	8.00	11.60	—3.60	2.00	6.00
Value of average unfertilized yield.....					72.67				
	Rotation III: Corn-soybeans-wheat-clover. All crops removed.								
2	.....	80	.....	.....	21.08	5.00	16.08	.....	.....
3	.....	80	20	.....	24.98	6.20	18.78	.....	.....
5	20	80	20	.....	34.59	9.50	25.09	.....	.....
6	60	144	60	.....	42.38	22.10	20.28	.....	.....
8	72	152	60	6	41.86	24.50	17.36	10.20	31.66
9	120	180	120	10	47.14	37.50	9.64	14.00	33.14
Value of average unfertilized yield.....					77.15	. .			

*In raw phosphate rock. **In steamed bonemeal.

COMPARISON OF VARIETIES

DEPARTMENT OF AGRONOMY

CORN

Fifteen varieties of corn have been tested on the Mahoning County Experiment Farm, Table 9. Of those that have been tested for 3 and 4 years, Leaming (Frost), seed of which was secured from Lake County, yielded highest. Yields are based upon weight of ear-corn at husking time. Darke County Mammoth from Darke County is second; Medina Pride from Medina County, third; Ohio 84 and Clarage, both from Wooster, fourth and fifth. Of these, Darke County Mammoth is the latest maturing and carries the highest percentage of water at husking time. It is, perhaps, a little too late on the average for best results here.

Corn silage.—Seven varieties of corn and one of sorghum have been tested for 3 years for yields of silage, Table 10. The late-maturing ensilage sorts, seed of which is produced in southern states, yielded the highest tonnage per acre. Eureka is first; Old Virginia, second; and Blue Ridge, third. The yield of sorghum is low as compared with corn.

OATS AND OTHER SPRING CEREALS

Seventeen varieties of oats and one each of barley, emmer, and spring wheat have been tested for a 6-year period, Table 11. Of the oats, Miami is first in yield; Ohio 6222, a selection from the Improved American, second; Silver Mine, third; and Big Four, fourth. The yields of barley, emmer, and spring wheat are low and uncertain.

Date of seeding oats.—A 5-year test of date-of-seeding oats is reported in Table 12. The average results of yield of grain are not given in the table, because so many dates have been skipped in making the seedings. Inspection of the table shows that early seeding paid best in 1918 and 1920, both good oat years, and late seeding paid best in 1917, 1919, and 1921, when the yields were not so good.

WHEAT

Twenty-one varieties of wheat have been tested, for the most part for a period of 4 years, Table 13. Fultz leads with an average yield of 31.17 bushels, Ohio 9920 second with 30.76 bushels, Fulhio third with 30.54 bushels, and Valley fourth with 30.52 bushels per acre. The yields in 1920 were unreliable and are not reported.

Date of seeding wheat.—The results of a five year test of the date-of-seeding wheat are given in Table 14. Some dates have been left out, making the average somewhat untrustworthy, but it is noted that seeding from the first to the middle of September has given better results than late seeding. If the Hessian fly is not threatening, early seeding seems preferable in order to get the wheat well established before winter sets in.

TABLE 9.—VARIETIES OF CORN, YIELD PER ACRE

Variety	1918	1919	1920	1921	Average	
					Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Clarage	64.79	75.70	62.87	72.77	69.03	2,940
Leaming (Frost)	73.33	76.28	86.09	84.96	80.16	3,366
Ohio 84	71.98	69.35	62.80	83.44	71.89	3,250
Medina Pride	74.13	78.82	70.44	73.29	74.17	3,300
White Cap	50.72	72.81	73.94	75.29	68.18	2,916
Darke County Mammoth	73.02	87.51	66.87	71.48	74.72	3,537
Golden Glow	57.10	80.42	50.66	73.55	65.43	2,412
Silver King	58.46	72.48	61.99	72.68	66.40	2,900
York's Yellow Dent	63.13	72.70	55.75	.....	63.86	2,283
Pride of the North	60.18	69.17	49.42	72.92	62.92	2,912
Van Wye's Yellow Dent	.....	73.25	55.66	61.27	63.39	2,700
Chub's Yellow Dent	.....	.....	.....	70 05	.....	2,900
Wetmer's White Cap	.....	.....	42.37	60.06	.....	2,100
Stones' Calico	.....	.....	.....	56.56	.....	2,000
Leaming	.....	.....	.....	81.93	.....	4 300

TABLE 10.—VARIETIES OF CORN FOR SILAGE, YIELD PER ACRE AND 3-YEAR AVERAGE

Variety	1919	1920	1921	Average
	Tons	*Tons*	*Tons*	*Tons*
Blue Ridge	10.41	8.39	15.93	11.58
Clarage	6.94	4.72	8.60	7.08
Leaming (Frost)	7.53	6.26	11.20	8.33
Darke Co. Mammoth	8.63	7.61	15.00	10.41
Reid (Orcutt)	9.29	7.77	13.80	10.28
Old Virginia	12.36	10.39	19.80	14.18
Eureka	13.41	11.04	19.40	14.62
Early Amber sorghum	4.66	3.44	8.40	5.50

TABLE 11.—VARIETIES OF OATS, YIELD PER ACRE

Variety	1920	1921	6-year average*	
			Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Lb.*
Ohio 7009	47.32	34.15	42.61	1,871
Ohio 8550	47.43	43.73	47.53	2,059
Burt	48.74	41.86	44.49	2,302
Miami (Ohio 6203)	75.09	46.65	57.79	2,175
Ohio 201	64.93	44.99	51.04	3,133
Ohio 6222	73.11	41.66	57.25	2,835
Big Four	73.11	46.03	54.64	2,485
Silver Mine	69.93	48.11	55.52	2,659
Swedish Select	69.52	35.09	48.37	2,407
Storm King	58.68	34.99	45.42	2,862
Joanette	64.72	46.24	52.02	2,788
Golden Rain	70.03	46.34	51.50	2,724
Victory	68.81	45.73	51.49	2,837
Corn Belt	61.21	35.93	45.62	2,669
Detmers New Bumper	54.76	34.78	45.22	2,526
Wideawake	61.91	41.76	47.57	3,556
Albion (Iowa 103)	47.63	46.65	50.15	2,166†
Oderbrucker barley	26.87	28.96	22.06	2,083
Emmer	30.62	31.25	27.89	2,394
Blue Ribbon spring wheat	8.33	22.06	13.91	2,381

*For the individual years of 1916-1919, see Ohio Agr. Exp. Sta. Bul. 344, part VII.
†5-year average.

TABLE 12.—DATE OF SEEDING OATS, YIELD PER ACRE 5-YEAR AVERAGE OF STRAW

Date Seeded	1917	1918	1919	1920	1921	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
March 26-28	.....	62.66	25.53	76.25	33.98	2,365
April 4- 5	55.62	.....	31.87	.....	37.03	2,022
April 11-12	55.47	.....	.....	68.75	.....	2,212
April 14-16	.....	58.75	33.44	.....	33.59	1,975
April 18-20	57.19	50.78	.....	67.19	.....	2,498
April 25-26	57.19	.....	38.75	.....	40.00	2,100
May 2- 5	50.00	52.34	43.59	55.62	30.31	2,204
May 9-11	53.44	39.69	.....	.....	.....	1,935
May 13-14	.....	.....	37.19	54.69	37.50	2,170
May 20-22	.....	38.12	.....	47.19	.....	1,985

TABLE 13.—VARIETIES OF WHEAT, YIELD PER ACRE
DATE OF SEEDING WHEAT, YIELD PER ACRE

Variety	1917	1918	1919	1921	4-year average	
					Grain	Straw
	Bu.	*Bu.*9	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Velvet Chaff	27.11	26.1	27.78	18.46	24.88	2,380
Fultz	38.56	32.71	33.50	19.90	31.17	2,612
Trumbull	34.00	32.73	27.65	22.68	29.26	2,467
Fulhio (Ohio 127)	35.69	29.92	32.67	23.90	30.54	2,531
Fultzo Mediterranean	28.69	23.57	27.89	21.52	25.42	2,286
Poole	28.56	30.89	27.79	21.10	27.08	2,500
Portage	31.34	24.91	32.20	23.40	27.96	2,339
Ohio 9920	35.91	29.41	36.03	21.68	30.76	2,579
Harvest King	31.22	30.89	30.37	22.23	28.68	2,432
Red Wave	28.92	32.28	26.56	.....	29.25	2,742
Dawsons Golden Chaff	27.33	29.94	32.08	20.04	27.35	2,551
American Bronze	26.97	29.97	29.84	17.96	26.18	2,816
St. Louis Grand Prize	28.25	29.58	.....	19.12	25.65	2,388
Gypsy	33.94	35.44	27.95	21.52	29.71	3,009
Gladden	36.61	30.35	30.53	21.82	29.83	3,005
Goens	25.36	21.61	27.64	.....	24.87	2,238
Valley	32.69	35.52	28.67	25.19	30.52	2,768
Nigger	30.86	22.77	32.39	19.90	26.48	2,219
Marvelous	30.44	25.19	28.36	23.38	26.84	2,492
Red Wonder	31.19	21.02	29.11	21.30	25.65	2,226
Mediterranean	.....	.....	24.25	22.41	23.33	2,793

DATE OF SEEDING WHEAT, YIELD PER ACRE

Date Seeded	1917	1918	1919	1920	1921	5-year average..	
						Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
September 1- 2	26.67	26.00	25.17	3.66	16.67	19.63	2,594
September 8-12	31.00	24.25	25.17	7.33	13.83	20.31	2,139
September 15-19	27.50	24.25	24.50	6.67	.....	20.73	2,241
September 20-22	19.00	23.67	21.58	.....	11.17	18.85	2,421
September 30	25.17	21.83	.....	6.67	.....	17.89	1,893
October 4-6	25.00	10.33	.....	.....	11.15	15.61	1,449
October 9-11	.....	.....	20.33	7.50	8.50	12.11	1,773
October 20-22	.....	.....	17.17	2.83	9.67	9.89	1,307

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BULLETIN

OF THE

Ohio Agricultural Experiment Station

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COUNTY EXPERIMENT FARMS IN OHIO

PART VIII

THE BELMONT COUNTY EXPERIMENT FARM

FOURTH AND FIFTH ANNUAL REPORTS, FOR 1920 AND 1921

C. G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

C. E. PILCHER, FOREMAN, 1920
W. E. DOHERTY, FOREMAN, 1921

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1921	1922
Original costs: land and buildings	$14,384.09	$14,384.09
Permanent improvements to March 1, 1920 and 1921	3,968.89	4,564.37
Permanent improvements made during year ended March 1, 1920: Water system to dairy barn and milkhouse partial cost, $140.99; repairs to cow barn, $14.55; farrowing houses, $29; repairs on house No. 1, $67.10; completing milkhouse, $120.79; variety orchard, $27.72; investment orchard, $61.96; sod-mulch orchard, $9.03; legume sod-mulch orchard, $30.60; peach orchard, $46.13; grove, $17.39; ornamental plantings, $30.22—total	595.48	
March 1, 1921: Fencing, $104.46; plantings, $55: barn bridge, $33.38—total		192.84
Total permanent investment	$18,948.46	$19,141.30
Operating equipment:		
Livestock:		
1920: 4 horses, $550; 10 cattle, $700; 4 hogs, $130—total	$ 1,380.00	
1921: 4 horses, $500; 12 cattle, $600; 4 hogs, $135—total		$ 1,235.00
Machinery, tools, and harness	967.35	806.35
Crops, feeds, and seeds:		
1920: corn, $170; oats, $25; wheat, $10.40; hay, $437; silage, $100; mill feed, $26.30; seed corn, $10.50; grass seed, $2.00—total	781.20	
1921: corn, $130; oats, $4.40; hay, $240; silage, $11.80; rye, $9; mill feed, $61; seed corn, $7; grass seed, $8—total		471.20
Fertilizer	60.50	45.75
Fence material, wire	134.50	44.00
Containers	11.30	9.05
Office equipment	25.00	42.90
Bedroom equipment		10.59
Lumber	7.50	67.50
Sundries	3.30	3.80
Total operating equipment	$ 3,370.65	$ 2,736.14
Total investment	22,319.11	21.877.44

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$2,025.59	$1,949.13
From Farm sales:		
Livestock and products:		
1920—Hogs, $174.30; horses, $280; calves and hides, $89.71; butterfat and milk, $471.68—total	1,015.69	
1921—Hogs, $486.07; calves, $32.25; butterfat, $398.50; livestock fees, $10.50—total		927.32
Crops:		
1920—Wheat, $129.71; hay, $58.15; apples, $16.85; peaches, $38.99—total	243.70	
1921—Wheat, $99.83; hay, $45.72—total		145.55
Sundries	51.44	50.16
Total receipts	$3,336.42	$3,072.16
Cash returned by superintendent	14.25	
Balance brought forward	373.43	307.46
	$3,724.10	$3,379.62

Cr.

By Expenditures

For labor	$2,028.52	$2,128.48
For current expenses	1,029.40	778.75
For permanent improvements:		
1920—Building material, $76.90; water supply, $114.28; plantings, 97 cents—total	192.15	
1921—Building material, $5.15; fence, $40; plantings, $55; lumber for barn bridge, $33.38—total		133.53
For machinery and tools	112.06	15.98
For rebate on horses	25.00	
For returned cream checks for which payment was refused by bank	29.51	
Total expenditures	$3,416.64	$3,056.74
Balance carried forward	307.46	322.88
	$3,724.10	$3,379.62

ITEMIZED CURRENT EXPENSES

	1920	1921		1920	1291
Seeds	$ 21 54	$ 21 10	Implement repairs	$ 20.00	$ 28.48
Feed	95 24	147 88	Engine maintenance	6 55	2 40
Fertilizer	175 22	107 61	Building main.	135.03	63.80
Binding material	6 05	9 00	Water system main.	3 10	17.50
Spray material	18 75	10.30	Transportation	142 78	97.58
Fence repair	22 20	.65	Communication	86 29	117.19
Livestock equipment	30 21	18.41	Publicity	4 36	
Horse shoeing	21 50	30.20	Miscellaneous hdw.	6 58	1.73
Livestock fees	8.00		Office supplies	17.25	15.20
Livestock incidentals	67 63	9 91	Containers		1.13
Veterinary service	46.37	4.55	Gasoline and oil	19 75	21.93
Machine hire	75.00	36.61	Bedroom furnishings		15.59
			Total	$1,029.40	$778.75

CROP AND LABOR STATISTICS, 1920 AND 1921

	1920	1921
Total area of farm	169. acres	169. acres
Area cultivated	70.34 acres	87.42 acres

Plot Work

	1920			1921		
	Number of plots	Acres	Yield per acre	Number of plots	Acres	Yield per acre
Corn	23	3.00	49.7 bu.	23	3.99	66.7 bu.
Corn silage				1	1.00	8 tons
Oats	10	.67	45.7 bu.	8	.53	42.8 bu.
Wheat	20	1.67	11.3 bu.	20	1.66	19.1 bu.
Soybeans	11	1.00	disced and hogged	11	1.32	disced
Spring wheat				1	.06	13.6 bu.
Hay	20	2.00	1.2 ton	20	2.01	2.33 tons
Barley				1	.06	28.3 bu.
Pasture	22	5.85	pastured	22	2.25	pastured
Totals	106	15.19		107	12.90	

Field Crops

Corn (husked)		13.0	49.22 bu.		8.5	58.8 bu.
Corn (silage)		5.0	4.82 tons		5.0	4.6 tons
Wheat		7.5	8.53 bu.		4.0	16.75 bu.
Oats		3.5	16.90 bu.		6.5	11.8 bu.
Rye		2.0	12.60 bu.		3.5	12.0 bu.
Soybeans		5.0	1.17 tons		4.0	disced
Pea and oat hay		1.5	1.41 bu.			
Hay (mixed)					24.6	1.3 tons
Hay (mixed)					5.0	clipped
Hay (timothy)		19.0	1.54 tons			
Totals		56.5			61.1	
Orchard					13.43	

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

	Corn	Oats	Wheat	Mixed hay
	Bu.	*Bu.*	*Bu.*	*Tons*
Highest 1920	73.70	60.00	21.55	2.06
Highest 1921	87.14	48.28	30.00	1.85
Lowest 1920	45.85	38.90	4.45	.71
Lowest 1921	57.85	25.31	10.16	.75

LABOR

	1920	1921
Number of work horses	4	4
Number of crop acres per work horse	17.6	21.8
Hours of man-labor for year beginning March 1	4,258.5	4,160.0
Hours of horse-labor for year beginning March 1	7,748.5	8,010.0

REPORT OF WORK FOR 1920 AND 1921

CARY W. MONTGOMERY

DAIRY HERD

The original plan called for the establishment of a dairy herd on the farm, and the work was started in the fall of 1917. Owing to many difficulties, chief among which is the high price of material and labor, it has not been possible to remodel the barn for conducting the work in a satisfactory manner.

While sufficient data has not yet been collected nor time elapsed to warrant definite conclusions, yet it would seem from our work that building up a high-producing herd of cows, starting with ordinary grade and even registered cows and a registered meritorious male, is not to be accomplished in a few years. An individual production record and summary for 1920-21 follow:

DAIRY SUMMARY

HOGS

A few hogs are kept for utilizing the skimmilk and the extra pasture. The results for 1920 and 1921 show a loss as figured in the summary for the two years. While these results do not prove that the keeping of hogs to furnish the home meat supply and probably some to sell to the nearby villagers is not profitable, it does indicate that keeping hogs under Belmont County conditions in a larger way is not advisable.

CROPPING SYSTEM

When the work of the farm was first planned it was thought wise to adopt a long rotation for a cropping system: corn, wheat, clover hay, pasture, pasture. But it has been found that even with one plowing in five years a part of the land which it was planned to cultivate will erode; therefore, the acreage devoted to cultivated crops must be reduced. To pursue the same rotation on a reduced acreage will not supply sufficient corn and straw for the livestock, so one year of pasture is cut off. Because of winter injury, wheat is not a certain crop, nor is it easily sold. For part of the wheat rye, which is more hardy than wheat, has been substituted and the grain will be fed to hogs. Part of the corn stubble was planted to oats in the hope of producing a cow feed cheaper than bran. Even with a four-year rotation probably not enough grain will be grown for the cows and hogs so that some fairly level land near the barn will be devoted to corn for silage.

A 2-year rotation of corn and soybeans on sloping land was found to loosen the soil so much that it eroded badly. To avoid this a rotation of corn and oats with clover sown in the oats as a plow-down crop will be substituted.

PASTURES

Tests for improving "run-out" pastures indicate that, where the land will admit of plowing without erosion, the quickest and best way to get a good sward of nutritious herbage is to plow, prepare good seed bed, apply lime and phosphate, and sow a mixture of grasses, such as timothy, red top, orchard grass, blue grass, red clover, alsike, and alfalfa. Liming and fertilizing without sowing seed is a rather slow process of improving pastures. An outstanding successful feature for the improvement of pastures is the practice of clipping in June and August.

ALFALFA

Alfalfa is easily started on this farm, but it pulls out during winter. The Grimm alfalfa is being tested to see if it will hold better.

ORCHARDING

As some of the land, too sloping to cultivate, is well adapted to orcharding, the orchard area is being enlarged. The trees have made a satisfactory growth, but have not yet come into bearing. The total cost to date is $1,006.29.

TABLE 1.—FINANCIAL OUTCOME OF ORCHARD WORK, 1917 to 1921

	Apples								Peaches	
	Sod mulch 124 trees		Legume mulch 124 trees		Variety 124 trees		Investment 200 trees			
Year	Costs	Cost per tree	Costs	Cost per tree	Costs	Cost per tree	Costs	Cost per tree	Costs	Receipts
1917	$ 71.78	$ .578	$ 71.78	$ .578	$ 71.78	$ .578	.....	.....	$114.77	
1918	11.07	.098	11.06	.098	11.06	.098	.....	.....	54.84	
1919	18.50	.149	18.50	.149	18.50	.145	$110.84	$ .56	38.35	
1920	9.03	.073	39.63	.320	27.72	.217	61.96	.31	46.13	$44.50
1921	30.08	.240	31.67	.260	49.73	.400	36.55	.18	50.97	none
Total....	$140.45	$1.138	$172.64	$1.405	$178.79	$1.438	$209.35	$1.05	$305.06	$44.50

SILAGE

The making of silage has not been successful, much of it molding and spoiling. The cause of failure may be attributed to letting the corn get too ripe before harvesting, not having a water supply

to wet it down, and to poor distribution and insufficient tramping in the silo. It is intended to change to Eureka corn for silage as experiments at the main station seem to show that more milk can be produced from an acre of this ensilage variety than from the grain corns.

In the hog and dairy summaries, good wages are credited the men and a liberal rate is allowed for pasture. The cost of keeping a sire is high for the number of females kept.

Farmers usually deduct interest on investment, depreciation, feed, and miscellaneous costs and credit the balance, if any, to labor.

FINANCIAL SUMMARY OF DAIRY WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Inventory March 1, 1920		Inventory February 28, 1921	
Dairy barn	$1,080.00	Dairy barn	$1,000.00
Silo	300.00	Silo	270.00
Milk house	310.00	Milk house	425.00
5 cows	550.00	5 cows	500.00
Equipment	2.50	3 heifers	150.00
Expenses:		2 calves	50.00
Man-hours, 1377.5 at 34c	454.75	Water system	140.00
Horse-hours, 34 at 20c	6.80	Equipment	113.00
Auto hire, 279 miles at 7c	19.53	Receipts:	
Feeds consumed*	831.33	Cream	495.00
Equipment bought	119.70	Milk used in family	84.82
Water system installed	140.99	Skimmilk	132.35
Veterinary	18.00	Veal calves	83.55
Finishing dairy house	127.04	Manure produced	152.62
Cow testing dues	19.00	To balance (loss)	395.65
Meals for tester	5.55		
Miscellaneous items	6.80		
Totals	$3,991.99	Totals	$3,991.99

*Includes pasture at $2.75 a month per cow.

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Dairy barn	$1,000.00	Dairy barn	$ 975.00
Land, 2 acres	160.00	Water system	130.00
Silo	270.00	Silo	265.00
Milk house	425.00	Milk house	420.00
5 cows	500.00	8 cows	500.00
3 heifers	150.00	4 heifers	150.00
2 calves	50.00	2 calves	30.00
Water system	140.00	1 bull	100.00
Equipment	113.00	Land, 2 acres	160.00
1 bull	100.00	Equipment	76.80
Expenses:		Receipts:	
Man-hours, 1247 at 35c	436.54	Cream	403.46
Horse-hours, 108 at 22c	23.76	Skimmilk	148.29
Auto hire	47.88	Veals	47.52
Feed	*510.02	Milk used in family	77.99
Bedding	20.80	Manure produced	154.42
Equipment	2.45	To Balance (loss)	316.30
Veterinary	1.85		
Miscellaneous	3.48		
Totals	$3,954.78	Total	$3,954.78

*Includes pasture at $2.42 per month per cow.

FINANCIAL SUMMARY OF HOG WORK

March 1, 1920 to February 28, 1921

DEBITS		CREDITS	
Inventory March 1, 1920		Inventory February 28, 1921	
Livestock	$145.00	Livestock	$130.00
Equipment	17.00	Equipment	42.00
Expenses:		Receipts:	
Rent of land, 1¼ acres	12.50	Livestock sold	174.30
Material and labor for building cots and fences	49.00		
Feed	430.02		
Man-hours, 169 at 34c	57.46		
Horse-hours, 1 at 20c	.20	To balance (loss)	364.88
Totals	$711.18		$711.18

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
Inventory March 1, 1921		Inventory February 28, 1922	
Livestock	$130.00	Livestock	$130.00
Equipment	42.00	Equipment	17.50
Expenses:		Receipts:	
Rent of land, 1¼ acres	12.50	Livestock sold	486.07
Feed	391.80	Boar services	10.50
Man-hours at 35c	124.77	To balance (loss)	757.00
Total	$701.07	Total	$701.07

NOTE. The depreciation in livestock in 1920 was due to the lower price per pound. The livestock sold did not nearly pay for the feed consumed, mostly because of the high price of feed during the early part of the season and low price of hogs at time of sale.

TABLE 2.—FEED AND BUTTERFAT RECORD OF DAIRY HERD MARCH 1, 1920 TO FEBRUARY 28, 1922

	Butterfat, pounds			2-year average	
	1920	1921	Average	Feed cost	Net over feed cost
Rose, R. J	273.81	230.35	252.08	$ 88.97	$ 58.52
Goldie, R. J	290.49	298.1	294.29	88.91	72 65
Nell, R. J	162.66	141.0	151.83	80.33	3.27
Spot, G. H	270.19	277.5	273.84	110.81	57.88
Blackie, G. H	289.19	276.3	282.74	107.05	72.36
Mary,* R. J		281.5		54.08	62.05
Baby,† R. J		111.3		35.95	12.21
Lassie,‡ G. H		59.7		23.65	2.72

*Freshened May 2, 1921; Dam Goldie, Sire No. 166499.
†Freshened July 3, 1921; Dam Nell, Sire No. 166499.
‡Freshened December 5, 1921; Dam Blackie, Sire unknown.
The records for these three cows are for 1921 only.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

Because of the hilly topography of the greater part of Belmont County it seems desirable to keep the land in grass as much of the time as practicable, to avoid the washing which follows when hillsides are plowed. This practice is in conformity with the general experience of the farmers of the county, the area in the cereal crops having steadily diminished during the last 60 years, while that in meadows has as steadily increased. A 5-year rotation, therefore, was adopted in which corn and wheat, each grown one season, was to be followed by 3 years of clover and timothy, thus requiring but one plowing in the 5 years of the rotation.

Similar rotations, in which timothy is allowed to occupy the land for an even longer period, and too often without any manuring or fertilizing except that given to one of the grain crops, have caused the opinion that timothy is a particularly exhaustive crop. It seems well, therefore, to study the effect of fertilizers and manure on the timothy crop itself and through this crop on the general rotation. An experiment has therefore been planned in which the fertilizing materials are to be distributed as shown in Table 3.

TABLE 3.—Plan of fertilizing in 5-year rotation of corn, wheat, clover, timothy, and timothy, Belmont County Experiment Farm

Plot	Fertilizing material: pounds per acre for entire rotation	Distribution of fertilizers—pounds per acre				
		Corn	Wheat	Clover	Timothy	Timothy
1	None					
2	Acid phosphate, 600 lb.	200	200		200	
3	Acid phosphate, 600 lb. Muriate of potash, 48 lb.	200 16	200 16		200 16	
4	None					
5	Acid phosphate, 600 lb. Muriate of potash, 48 lb. Nitrate of soda, 120 lb.	200 16 40	200 16 40		200 16	 40
6	Acid phosphate, 600 lb. Muriate of potash, 48 lb. Nitrate of soda, 120 lb. Ground limestone, 2 tons	200 16 40 2 tons	200 16 40		200 16	 40
7	None					
8	Manure, 10 tons	5 tons			5 tons	
9	Manure, 10 tons Acid phosphate, 400 lb.	5 tons 200			5 tons 200	
10	None					

The fifth block of land set aside for this experiment required some clearing, which has not yet been accomplished, so that the experiment is as yet running as a 4-year rotation, in which 5 crops

of corn, 4 of wheat, and 2 each of clover and timothy, have thus far been harvested, the first seeding of clover having failed. The records of these crops are given in the following tables.

This experiment has not yet been continued long enough to bring all the crops fully under the effect of the treatment and its results cannot be considered as decisive; but, as an indication of the general trend of the work, the results are summarized for comparative purposes in Table 6. This table gives the value of increase and cost of treatment, computing corn at 50 cents a bushel for the grain and $4.00 a ton for the stover; wheat at $1.00 a bushel for the grain and $2.00 a ton for the straw; and hay at $10.00 a ton. The fertilizers are computed at $20.00 a ton for acid phosphate and $60.00 a ton for muriate of potash and nitrate of soda, all spread on the field. Ground limestone is computed at $4.00 a ton, and manure at the nominal price of 50 cents a ton to cover cost of hauling out and spreading. From the balance must be deducted the small cost of harvesting and marketing the additional yields produced by the treatment.

The results are somewhat contradictory as it is not probable that the addition of potash to the fertilizer has reduced the yields. The outcome seems to be chiefly due to irregularity in the yield of the corn crops on Plots 2 and 3. Such irregularities are always to be expected when land is first brought under such experiments. It is a common experience, however, that lime is essential to the full effect of fertilizers carrying potash.

The effect of acid phosphate is marked, both when used alone on Plot 2 and when added to manure on Plot 9.

The gain in yield on Plot 6 indicates a need of nitrogen, but the gain is not sufficient to cover the cost of nitrogen in nitrate of soda. Nitrate of soda, however, is both the cheapest and the most effective chemical carrier of nitrogen. Computed as ammonia, the cost of a pound of ammonia in nitrate of soda at $60.00 a ton would be about 16 cents, whereas the cost of a pound of ammonia is often more than twice that amount in factory-mixed fertilizers. In other words, if nitrate of soda cannot be used with profit then it will not pay to purchase "ammonia" in any form.

The effect of limestone is outstanding, not only in the final summing up but in every crop, although the greatest effect is shown in the hay crops. The limestone is computed in this table at $4.00 a ton, a price that ought to be sufficient to get it upon the average farm, especially in a region where there are local outcrops of limestone that might be utilized by cooperative work.

If valued at the cost of its elements in nitrate of soda, acid phosphate, and muriate of potash the cost of a ton of manure would be about $2.50, instead of 50 cents as computed in the table, and at this cost it would be a very expensive fertilizer.

The long-continued experiments at Wooster are showing that when manure is used systematically its effectiveness steadily increases, and these experiments also have shown that manure should be regarded primarily as a source of nitrogen and potash, and as such should always be reinforced with some carrier of phosphorus, of which acid phosphate is the most effective and the cheapest. This point is brought out by comparison of Plots 2 and 9 in the Belmont test, 400 pounds of acid phosphate producing nearly as great an increase on manured land, over and above the increase due to the manure itself, as 600 pounds does on unmanured land.

TABLE 4.—Total treatment per acre for 4-year period, value of increase, cost of treatment, and balance, Belmont County Experiment Farm

Plot No.	Total treatment for 4-year period	Total value of increase	Total cost of fertilizer	Balance
2	Acid phosphate, 600 lb.	$11.65	$ 6.00	$ 5.65
3	Acid phosphate, 600 lb.; muriate of potash, 48 lb.	9.97	7.44	2.53
5	Acid phos., 600 lb ; mur. potash, 48 lb.; nit. soda, 80 lb.	14.82	9.84	4.98
6	Acid phos., 600 lb.; mur. pot., 48 lb.; nitrate soda, 80 lb.; ground limestone, 2 tons.	30.03	17.84	12.19
8	Manure, 10 tons.	11.80	5.00	6.80
9	Manure, 10 tons; acid phosphate, 400 lb.	21.94	9.00	12.94

TABLE 5.—Fertilizers, manure, and limestone on CORN and WHEAT in rotation with clover, timothy and timothy, Belmont County Experiment Farm. Yield and increase per acre

Plot No.	Treatment per acre	1920 Yield Grain Bu.	1920 Yield Stover or Straw Lb.	1920 Increase Grain Bu.	1920 Increase Stover or Straw Lb.	1921 Yield Grain Bu.	1921 Yield Stover or Straw Lb.	1921 Increase Grain Bu.	1921 Increase Stover or Straw Lb.	Average Yield Grain Bu.	Average Yield Stover or Straw Lb.	Average Increase Grain Bu.	Average Increase Stover or Straw Lb.	Plot No.
	Corn	Block D				Block A				5-year average				
1	None	42.86	2,500			81.00	3,450			59.91	3,358			1
2	Acid phosphate, 200 lb	51.43	2,500	10.00	—67	87.14	3,650	6.47	183	67.14	3,670	7.06	361	2
3	Acid phosphate, 200 lb.; muriate potash, 16 lb	37.14	2,600	—2.86	—33	81.43	3,700	1.10	217	62.57	3,520	2.32	261	3
4	None	38.57	2,700			80.00	3,500			60.43	3,210			4
5	Acid phos., 200 lb.; mur. potash, 16 lb.; nit. soda, 40 lb.	50.00	2,700	9.52	100	80.00	3,550	1.43	117	64.00	3,490	4.48	253	5
6	Acid phos., 200 lb.; mur. pot., 16 lb.; nit. soda, 40 lb.; ground limestone, 2 tons	54.29	2,900	11.91	400	84.29	3,850	7.15	483	68.57	3,370	9.96	107	6
7	None	44.29	2,400			75.71	3,300			57.71	3,290			7
8	Manure, untreated, 10 tons	37.14	2,400	—8.10	—133	82.86	4,250	13.10	1,300	65.00	3,840	8.00	637	8
9	Manure, untreated, 10 tons; acid phosphate, 200 lb	55.71	3,200	9.52	533	80.00	4,250	16.19	1,650	69.43	3,970	13.14	853	9
10	None	47.14	2,800			57.86	2,250			55.57	3,030			10
	Average unfertilized yield	43.22	2,600			73.64	3,125			58.41	3,230			
	Average fertilized yield	47.62	2,717			82.62	3,875			66.12	3,643			
	Wheat	Block C				Block D				4-year average				
1	None	2.17	490			10.17	1,190			12.71	1,492			1
2	Acidphosphate, 200 lb	3.83	770	1.66	320	11.50	1,060	.89	—103	16.83	1,652	3.86	148	2
3	Acid phosphate, 200 lb.; muriate potash, 16 lb	6.33	940	4.16	530	15.83	750	4.77	—387	18.96	1,705	5.72	189	3
4	None	2.17	370			11.50	1,110			13.50	1,527			4
5	Acid phos.; 200 lb.; mur. potash, 16 lb.; nit. soda, 40 lb	6.83	910	4.83	570	17.50	1,700	5.78	403	19.67	1,937	6.67	452	5
6	Acid phos.; 200 lb.; mur. potash, 16 lb.; nit. soda, 40 lb	7.83	1,050	5.99	740	23.33	1,700	11.38	217	22.41	2,060	9.91	618	6
7	None	1.67	280			12.17	1,670			12.00	1,400			7
8	Manure on corn and timothy	3.00	640	1.05	303	19.17	1,700	6.11	217	14.67	1,562	2.66	219	8
9	Manure and acid phosphate on corn and timothy	8.17	990	5.95	597	23.13	1,710	9.23	413	20.08	1,915	8.09	628	9
10	None	2.50	450			14.83	1,110			12.00	1,230			10
	Average unfertilized yield	2.13	397			12.17	1,270			12.55	1,412			
	Average fertilized yield	6.00	883			18.42	1,437			18.77	1,805			

TABLE 6.—Residual effect on CLOVER of treatment of previous crops and effect of fertilizing TIMOTHY in 4-year rotation of corn, wheat, clover, and timothy. Yield and increase per acre

Plot No.	Treatment per acre	1920		1921		Average	
		Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.	Yield Lb.	Increase Lb.
	CLOVER—Treatment on previous crops	Block B		Block C		2-year average	
1	None	1,837		1,853		1,845	
2	Acid phosphate, 400 lb	2,222	472	2,274	449	2,248	460
3	Acid phosphate, 400 lb.; muriate potash, 32 lb	1,890	228	2,274	478	2,082	353
4	None	1,575		1,768		1,671	
5	Acid phosphate, 400 lb.; muriate potash, 32 lb.; nitrate soda, 80 lb	2,686	1,064	1,853	169	2,269	616
6	Acid phosphate, 400 lb.; mur. potash, 32 lb.; nitrate soda, 80 lb.; ground limestone, 2 tons	3,614	1,946	3,116	1,516	3,365	1,731
7	None	1,715		1,516		1,615	
8	Manure, 5 tons	1,820	263	2,021	393	1,920	328
9	Manure, 5 tons; acid phosphate, 200 lb	1,995	595	2,526	785	2,260	690
10	None	1,242		1,853		1,547	
	Average unfertilized yield	1,592		1,747		1,669	
	Average fertilized yield	2,371		2,344		2,357	
	TIMOTHY—Treatment on timothy	Block A		Block B		2-year average	
1	None	1,977		1,684		1,830	
2	Acid phosphate, 200 lb	2,257	297	1,768	140	2,012	218
3	Acid phosphate, 200 lb.; muriate potash, 16 lb	1,995	53	1,768	196	1,881	124
4	None	1,925		1,516		1,720	
5	Acid phosphate, 200 lb.; muriate potash, 16 lb.*	2,117	163	2,105	589	2,111	376
6	Acid phosphate, 200 lb.; muriate potash, 16 lb.*	2,647	664	3,116	1,600	2,881	1,132
7	None	2,012		1,516		1,764	
8	Manure, 5 tons	2,625	555	1,684	252	2,154	403
9	Manure, 5 tons; acid phosphate, 200 lb	2,310	181	1,768	421	2,039	301
10	None	2,187		1,263		1,725	
	Average unfertilized yield	2,026		1,495		1,760	
	Average fertilized yield	2,325		2,035		2 180	

*40 pounds nitrate of soda to be added to second-year timothy when rotation is fully established.

COMPARISONS OF VARIETIES

DEPARTMENT OF AGRONOMY

CORN

Seven varieties of corn have been tested for yield of ear corn at husking time for a period of five years. Table 7. Cook's 75, a strain of Reid's from Hardin County, is first; Darke County Mammoth from Darke County, second; and a local variety (L. W. Hays), third. Cook's 75 gives the highest yield of stover; White Cap, second, and Ohio 84, third.

TABLE 7.—VARIETIES OF CORN, YIELD PER ACRE

	1917	1918	1919	1920	1921	Grain	Stover
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Darke County Mammoth	76.07	80.61	89.47	78.92	69.28	78.87	4,665
Leaming (P. D.)	82.51	67.26	76.61	68.21	76.43	74.20	3,935
Cook's 75	75.36	79.17	88.39	88.21	81.43	82.11	5,667
Ohio 84	59.64	70.13	78.75	71.79	78.21	71.70	4,875
White Cap	53.21	72.98	73.39	72.50	73.57	69.13	5,147
Local (L. W. Hays)	68.93	.....	81.96	78.92	80.71	77.63	4,443
Clarage	69.64	68.22	80.89	72.50	70.71	72.39	3,826

OATS, SPRING WHEAT, AND BARLEY

Three varieties of oats have been tested for a 5-year period; two for three years, and one for 4 years. Barley and spring wheat have been tested for 5 years. The three-year average yield of all varieties is given in Table 8. Of the oats, Big Four is first, Ohio 6222, a selection from Improved American, second; and Miami, third. Barley and spring wheat do not yield nearly as high as oats on the average.

TABLE 8.—VARIETIES OF OATS, SPRING WHEAT, AND BARLEY, YIELD PER ACRE

Variety						3-year average	
	1917	1918	1919*	1920	1921*	Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Ohio 7009	45.89	44.73	37.50	39.14	48.28	43.25	1,347
Miami (Ohio 6203)	60.55	67.59	39.14	57.66	42.19	61.93	1,909
Ohio 6222	55.05	70.28	30.47	59.76	38.43	62.70	2,313
Big Four	59.14	75.80	.....	54.84	.....	63.26	2,340
Silver Mine	58.90	59.38	.....	48.28	.....	55.52	2,350
Wideawake	54.22	58.43	.....	54.37	44.06	55.67	2,281
Blue Ribbon spring wheat	7.50	14.00	7.50	11.25	13.50	10.92	1,656
Oderbrucker barley	20.00	30.00	28.75	18.12	28.12	22.71	1,837

*1919 and 1921 are not included in average.

WHEAT

Seven varieties of wheat have been tested for 4 years, Table 9. Red Wave has the highest yield, 33.29 bushels; Gladden, second, 32.35 bushels; Ohio 9920, third, 30.30 bushels per acre. Gladden has given the highest yield of straw.

TABLE 9.—VARIETIES OF WHEAT, YIELD PER ACRE

Variety	1918	1919	1920	1921	4-year average	
					Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Velvet Chaff	28.75	34.25	21.06	32.00	29.01	2,823
Nigger	21.33	34.69	18.64	35.55	27.55	2,905
Gladden	33.66	36.48	22.48	36.78	32.35	3,332
Fulhio (Ohio 127)	33.83	35.26	19.14	26.22	28.61	2,757
Trumbull	32.41	36.25	17.97	18.77	26.35	1,949
Ohio 9920	23.83	38.14	23.23	36.00	30.30	2,712
Red Wave	31.66	34.36	28.14	39.00	33.29	2,982

SOYBEANS AND COWPEAS

In 1917 and 1918, six varieties of soybeans and one variety of cowpeas were tested for yield of grain. The yields were low. For the 2-year average, Ohio 9016 is first with 12.33 bushels; Elton, second with 11.93 bushels; and Medium Green, third with 11.87 bushels per acre. The cowpeas were frosted both years and not threshed. For detailed report see Ohio Agr. Exp. Station Bul. 344, Part VIII, Table 122.

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BULLETIN
OF THE
Ohio Agricultural Experiment Station
NUMBER 361 JUNE, 1922

COUNTY EXPERIMENT FARMS IN OHIO

PART IX

THE MADISON COUNTY EXPERIMENT FARM

FOURTH AND FIFTH ANNUAL REPORTS, FOR 1920 AND 1921

C G. WILLIAMS, DIRECTOR

CARY W. MONTGOMERY, CHIEF OF DEPARTMENT

H W ROGERS, SUPERINTENDENT
M A. NETTELHORST, FOREMAN

FINANCIAL SUMMARY

Inventories of Permanent Investment Costs and Operating Equipment, March 1, 1921 and March 1, 1922

	1920	1921
Original costs: land and buildings	$20,875.00	$20,875.00
Permanent improvements to March 1, 1920 and 1921	11,033.26	11,481.76
Permanent improvements during 1920 and 1921:		
1920—corn crib, $276.25; fence, $123 39; tile drains, $47; plantings (ornamental), $1.86—total	448.50	
1921—silo, $292.13; fencing, $359.47; draining barnyard, $20.82—total		672.42
Total permanent investment	$32,356.76	$33,029.18
Operating equipment:		
Livestock:		
1920—2 horses, $325; 14 pigs, $215—total	540.00	
1921—2 horses, $300; 44 hogs, $615—total		915.00
Machinery, tools, and harness	1,517.00	1,549.00
Crops, feed, and seeds:		
1920—corn, $555; oats, $9; hay, $60; silage, $92; mill feed, $15; seed corn, $6—total	737.00	
1921—corn, $459; oats, $91; silage, $168; hay, $63; straw, $8; mill feed, $7; seed corn, $15; salt, $2—total		813.00
Fertilizer	105.00	66.00
Fence material	114.00	
Fence material	45.00	35.00
Plot stakes	5.00	14.00
Sundries	12.00	16.00
Total operating equipment	$ 3,075.00	$ 3,408.00
Total investment	35,431.76	36,437.18

RECEIPTS AND EXPENDITURES

For the years ending February 28, 1921 and 1922

Dr.

To Receipts

	1920	1921
From County Maintenance fund	$ 951.19	$ 983.74
From Farm sales:		
Livestock and products:		
1920—horse, $150; cattle, $996.39; hogs, $111.49—total	1,257.88	
1921—hogs, $776.88; cattle, $242.15—total		1,019.03
Crops:		
1920—corn, $1,518.03; oats, $61.37; wheat, $622.55; hay, $155.09; fodder, $73.49—total.	2,430.53	
1921—corn, $534.41; oats, $36.73; wheat, $142.50; hay, $299.01—total		1,012.65
Threshing outfit		540.00
Cow feed	36.00	
Sundries	17.38	
Total receipts	$ 4,692.98	$ 3,555 42
Balance brought forward	608.13	52.71
	$ 5,301.11	$ 3,608.13

Cr.

By Expenditures

For labor	$ 2,281.15	$ 1,732.32
For current expense*	1,345.50	1,176.01
For permanent improvements:		
1920—building material, $276.25; fence, $123.39; drainage, $47; ornamental plantings, $1.86—total	448.50	
1921—building material, $241.12; fence, $135.25; plantings, $15.50; sawing lumber, $77.10—total.		468.97
For machinery and tools	937.29	132.00
For livestock: hogs	235.96	56.80
Total expenditures	$ 5,248.40	$ 3,566.10
Balance carried forward	52.71	42.03
	$ 5,301.11	$ 3,608.13

CROP AND LABOR STATISTICS, 1920 AND 1921

Area of farm in acres	1920	1921
Farmstead	2.71	2.71
Cultivated	132.92	134.63
Permanent pasture	14.07	13.33
Orchard	1.50	1.50
Woodlot	4.88	4.88
Public road	2.22	2.22
Farm roads	7.70	6.73
Totals	166.	166.

Plot Work

	1920			1921		
	No. of plots	Acres	Yield per acre	No. of plots	Acres	Yield per acre
Corn	56	5.6	58.1 bu.	56	5.6	43.1 bu.
Oats	10	1.0	63.3 bu.	10	1.0	29.7 bu.
Wheat	33	3.3	14.6 bu.	33	3.3	16.1 bu.
Soy hay	10	1.0	2.1 tons	10	1.0	1.3 tons
Mixed hay	.....	.....	.....	23	2.3	1.9 tons
Totals	109	10.9	.....	132	13.2	.....

Field Crops

Corn (grain)	.....	50.10	47.8 bu.	.....	49.82	48.2 bu.
Corn (silage)	.....	4.50	11.5 tons	.....	9.00	8.3 tons
Oats	.....	6.00	38.6 bu.	.....	32.97	14.2 bu.
Wheat	.....	25.03	14.0 bu.	.....	4.50	22.7 bu.
Timothy hay	.....	2.09	1.8 tons	.....	.....	.....
Mixed hay	.....	31.09	.7 ton	.....	25.44	2.1 tons
Corn (Orchard)	.....	.40	25. bu.	.....	.....	.....
Soybeans	.....	3.80	Unharvested	.....	.60	6.6 bu.
Totals	.....	122.92	.....	.....	122.33	.....
Less soys and corn in orchard	.....	.90	.....	.....	.90	.....
	.....	122.02	.....	.....	121.43	.....

HIGHEST AND LOWEST PLOT YIELDS PER ACRE

		Corn bu.	Oats bu.	Wheat bu.	Soyhay tons	Mixed hay tons
Highest	1920	78.8	79.7	32.2	2.9	.....
	1921	56.1	37.5	25.0	2.0	2.7
Lowest	1920	39.5	45.3	2.3	1.5	.....
	1921	27.4	14.0	7.1	.7	.9

Labor

	1920	1921
Number of work horses	5	5
Crop-acres per work horse	26.76	27.1
Man-hours for year beginning March 1	7,479	5,670
Horse-hours for year beginning March 1	4,941	5,476

*ITEMIZED CURRENT EXPENSES

	1920	1921
Seeds	$ 199.47	$ 138.16
Fertilizer	247.41	317.85
Binding material	19.90	15.90
Machine hire	80.45	227.49
Feed	183.35	167.61
Horse shoeing	43.20	22.00
Livestock equipment	9.65	9.75
Veterinary services	10.75	4.50
Livestock incident's	3.00	33 84
Building main.	187.92	22.88
Implement repairs	33.36	44.71
Drainage main.	27.23	
Plot fixtures		6.70
Fence main.	$ 21.45	$ 13.05
Engine main.	50.47†	4.31
Water supply main.	1.52	4.21
Transportation	93.38	8.00
Communication	32.70	39.57
Publicity	4.65	37.88
Office supplies	15.46	26.55
Miscellaneous hdw.	12.68	7.61
Insurance	67.50	
Oil and gasoline		8.24
Immunizing hogs		15.20
Total	$1,345.50	$1,176.01

†Includes oil and gasoline.

ANNUAL SUMMARY OF THE LIVESTOCK FARMING SIDE

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
First inventory		Second inventory	
Land, 103.48 A. @ $125	$12,935.00	Land, 103.48 A. @ $125	$12,935.00
Paths and roads 5.48 acres		Paths and roads 5.48 acres	
Buildings:		Buildings:	
House No. 1	3,350.00	House No. 1	3,283.00
House No. 2	1,435.00	House No. 2	1,411.30
Barn	1,750.00	Barn	1,715.00
Granary and tool shed	275.00	Granary and tool shed (2% depreciation)	269.50
Hog house	35.00	Hog house (2% dep.)	34.30
Silo	450.00	Silo	441.00
Garage and chicken house	200.00	Garage and chicken house	196.00
Small buildings	10.00	Small buildings	9.80
Fences, 500 rds.	300.00	Fences, 700 rds.	530.00
Livestock:		Livestock:	
2 horses	325.00	2 horses	300.00
2 mules (belonging to State)	300.00	2 mules (belonging to State)	275.00
1 horse (belonging to State)	50.00	1 horse (belonging to State)	40.00
1 brood sow	40.00	6 brood sows	300.00
12 shoats	170.00	38 shoats	315.00
1 suckling pig	5.00		
Livestock equipment:		Livestock equipment:	
Horses	161.00	Horses	148.00
Hogs	33.00	Hogs	31.00
Orchard equipment	9.00	Orchard equipment	3.00
Machinery:		Machinery:	
Cropping	1,025.00	Cropping	1,044.00
Miscellaneous	309.00	Miscellaneous	286.00
Crops and feed on hand:		Crops and feed on hand:	
Hay, 5 tons 60.00		Hay, 7 tons 63.00	
Corn, 1,100 bu. 475.00		Straw, 2 tons 8.00	
Silage, 15 tons 92.00		Corn, 900 bu. 459.00	
Oats, 30 bu. 9.00		Silage, 35 tons 168.00	
Cottonseed meal, 200 pounds 5.00		Oats, 275 bu. 91.00	
Tankage, 300 lbs. 10.00	651.00	Cottonseed meal, 200 pounds 5.00	
Seed corn, 5 bu.	6.00	Tankage, 75 lbs. 2.00	796.00
Miscellaneous supplies	120.00	Seed corn, 15 bu.	15.00
		Miscellaneous supplies	125.00
Totals	$23,664.00	Total	$24,503.90

SUMMARY OF RECEIPTS AND EXPENSES

March 1, 1921 to February 28, 1922

EXPENSES		RECEIPTS	
Total inventory, March 1, 1921	$23,664.00	Total inventory, Feb. 28, 1922	$24,503.90
Current expenses:		From County maintenance fund	983.74
Binding material	15.90	From farm sales:	
Building maintenance	22.88	Livestock:	
Communication	39.57	Hogs	498.38
Engine maintenance	4.31	Cattle	520.65
Fertilizer	227.85	Crops:	
Feed purchased	167 61	Corn	534.41
Fence maintenance	13.05	Oats	36.73
Horse shoeing	22.00	Wheat	142.50
Implement maintenance	44.71	Hay	299.01
Livestock equipment	9.75	Bills received:	
Livestock incidentals	33.84	From S. W. Test Farm for threshing outfit	450.00
Machinery hire	227.49	Credits from grain-farming side for:	
Miscellaneous hardware	7.61	Man-labor	206.76
Oil and gasoline	8.24	Horse-labor	75.60
Plot fixtures	6.70	Machinery charge*	25.20
Office supplies	26.55		
Publicity	37.88	Extra experimental work on livestock side more than on grain-farming side	75.00
Seeds	138.16		
Transportation	8.00		
Water system maintenance	4.21		
Veterinary	19.70		
Labor	1,732.32		
Permanent improvements:			
Building material	241.12		
Fencing	135 25		
Plantings	15.50		
Sawing lumber	77.10		
Machinery and tools	132.00		
Bills receivable:			
Threshing outfit sold to S. W. Test Farm	450.00		
Grain from grain-farming side, corn, 45 shocks fed to cattle	19.95		
Hogs purchased	56.00		
To balance (gain)	742.63		
Totals	$28,351.88	Totals	$28,351.88

*Machinery charge estimated at 5 cents per horse-hour.

ANNUAL SUMMARY OF GRAIN FARMING SIDE

March 1, 1921 to February 28, 1922

DEBITS		CREDITS	
First inventory		Second inventory	
Land, 62.52 acres @ $125	$7,814.00	Land, 62.52 acres @ $125	$7,814.00
Roads and paths 1.25 acres		Roads and paths 1.25 acres	
Buildings, corn crib	125.00	Buildings, corn crib	122.50
Equipment	none	Equipment	none
Fences, 228 rds.	136.00	Fences, 228 rds.	114.00
Grain on hand:			
25 shocks of stover	5.00		
200 bu. of corn	80.00		
Fertilizers on hand:			
2,800 pounds acid phosphate	42.00		
560 pounds nitrate of soda	27.00		
280 pounds muriate of potash	21.00		
Total inventory	$8,250.00		$8,050.00
Expenses:		Receipts:	
Man-hours, 646.6 @ 32c	206.76	Corn	232 49
Horse-hours, 504 @ 15c	75.60	Oats	30.73
Machinery charge*	25.20	Hay	294.75
Tractor hire	5.00	Stover	12.05
To profit	57.46		
Totals	$8,620.02	Totals	$8,620.02

*Machinery charge estimated at 5 cents per horse-hour.

NOTE: In the summaries no charge is made for rent of land, interest on investment, or overhead and it should be borne in mind that because of experimental work expenses are heavier than they otherwise would be.

ANNUAL REPORT FOR THE YEAR ENDING FEBRUARY 28, 1922

H. W. ROGERS

The object of the Madison County Experiment Farm is "To develop reliable information and demonstrate its practical application under local conditions." Each county has its particular problems which must necessarily be solved under local conditions. The county experiment farm provides the means for their solution and the management has included local problems among the lines of work under development.

The field of work in Madison County, however, is made to include problems of fundamental interest to agriculture in general as well as to the county. Grain and livestock farming, soil fertility, cereal varieties, livestock feeding, and rotation of crops are the chief subjects under experimentation.

The initial steps were made toward the establishment of an experiment farm in Madison County in 1916. A large amount of the experimental work must be of longer duration than the four or five years included in this report. Especially is this the case in the use of fertilizers, determining the best adapted rotations, and in a comparison of systems of farming. However, after this short period a number of pretty definite responses are noted from the experiments now in progress.

LIVESTOCK AND GRAIN FARMING

The farm is divided into livestock and grain-farming sections. Rotation and soil fertility experiments are carried out on each division to determine whether livestock farming or grain farming is the more profitable, and the effects of the two systems on the land. It is hoped that a system of cost accounting and noting the effects on the soil over a series of years, will determine what crops are most reliable and profitable for feeding purposes and for cash crops.

On the grain farm a field rotation of corn, oats, corn, and wheat is practiced. A clover cover crop is sown with the wheat and oats to plow down for the corn crops. The corn crops and the wheat each receives 200 pounds of acid phosphate and 20 pounds of muriate of potash per acre and the oats 100 pounds of acid phosphate per acre.

The field work on the livestock farm includes a five-year rotation of corn, soybeans, corn, wheat, and oats and clover. Six tons of phosphated manure per acre is applied to each corn crop and 320 pounds of acid phosphate to the wheat. The first corn crop is husked on the stalk and the second crop is ensiled.

It has not been possible to manage the grain farm entirely as a rented farm or as a farm operated by the owner, but as a combination of the two.

The land on the grain-farming side, because of previous ill-management, is not as productive as that on the livestock side. It should also be noted that the area devoted to roads and paths is much greater on the livestock side than on the grain-farming side and that the farmstead of five acres and the wood lot of nine acres are on the livestock side.

The summary for the two systems for 1921 will serve to illustrate the difference in the amount of capital needed to invest in an owner-operated farm as well as a livestock farm and a rented farm or grain farm. At present fences are expensive. The difference in amount of fence on the two farms will be still greater as the livestock operations are enlarged.

PERMANENT IMPROVEMENTS

The total labor and material costs for permanent improvements made in 1921 amounted to $796.04, distributed as follows: fences, $372.52; building maintenance, $110.57; silo, $292.13; and ditching, $20.82. Most of the labor on these improvements was done by the regularly employed farm help.

COST ACCOUNTING

Complete cost accounts were kept at the Madison County Experiment Farm. These included the production of all farm crops, livestock feeding, permanent improvements, and miscellaneous and overhead expenses.

In the following comparison of growing the various farm crops in 1921, the items of labor and expense are for crops grown in a field way and man-labor is charged at 32 cents and horse-labor at 15 cents an hour; seeds, fertilizers, and the use of tractor at their cost. The gross return per acre is figured on the market value of the grain on the farm at harvest time.

LABOR AND MISCELLANEOUS COSTS AND NET RECEIPTS PER ACRE

	Man hours	Horse hours	Tractor hours	Labor cost	Miscellaneous costs	Total costs	Yield per acre	Gross returns	Net returns
Corn	44.56	68.14	.925	$26.10	$ 5.43	$31.53	70.8 bu.	$26.90	$—4.63
Oats	9.85	13.16	.....	5.12	6.10	11.22	18.17 bu.	5.52	—5.70
Wheat	20.17	27.22	.....	10.53	13.23	23.76	22.8 bu.	29.17	5.39
Clover	13.7	14.00	.....	6.54	6.46	13.00	2.2 tons	19.80	6.80

The miscellaneous costs include fertilizer, seeds, twine, threshing, meals, and coal. Rent of land, interest on investment, machinery, and overhead charges are not considered.

The season was unfavorable for oats and, though they are a low cost crop, the receipts were not equal to the cost of production. Hay, due to the low cost of production, gave a larger net return than wheat.

Horses.—Following is the cost account per head for keeping the five work horses one year, beginning March 1, 1921 and ending February 28, 1922:

Number hours worked per horse	1,095
Depreciation	$ 20.00
Shoeing	3.65
Feed	48.06
Bedding	2.40
Labor caring for horses	26.49
	$ 100.60
Credit for manure produced	13.47
Total net expense	$ 87.13
Cost per hour for horse-labor	.079

PUBLIC INTEREST

The annual field meeting, August 2, was attended by about 250 people. The experimental work is yearly creating additional interest among farmers in the County.

In cooperation with the county agent and farm bureau, an experiment farm exhibit was made at the county fair. Occasional articles dealing with current phases of the work were published in the local papers. The experimental results were discussed at several farm bureau meetings and literature was distributed as a further means of placing the farm in the public service.

OBSERVATIONS

Drouth prevailed through July but was broken the first of August in time to save the corn crop. Each of the crops was

harvested in good condition and all plans for the year successfully carried out. The corn, wheat, and hay yields were good, but that of oats was low. Soybeans both as a forage and for seed crop are proving well adapted to this County.

Alfalfa was sown with oats as a nurse crop for an observation test in the application of acid phosphate and limestone. While both limestone and fertilizer show beneficial effects, yet the most marked results are noted in the growth of the alfalfa on the section receiving the acid phosphate.

Sweet clover has been given a trial as a cover crop sown with wheat and oats to be plowed down for corn. A good stand has been secured in most instances and when left until the middle of April quite a heavy growth was plowed under.

LIVESTOCK

Cattle.—Beef production is one of the main enterprises on the livestock farm. Problems concerned with the winter feeding of beef cattle now in the process of development include the following, viz: What rations are the most economical for beef production? What rotation is best adapted for growing these feeds? Should the corn all be put into the silo, leaving the ground in good shape for sowing wheat; or should part of the corn be husked from the stalk and fed dry, following with an oats crop in the rotation? Which method would provide the best distribution of labor, and what would be the difference in the cost of handling the crop? Is the oats crop as profitable as wheat, and what would be the effects on the soil from these two systems?

In an attempt to work out some of these problems a cattle feeding test was carried out during the winter 1921-22 to compare an all-silage with a silage-and-corn ration for fattening steers. The steers were divided into two lots and fed for a period of 133 days.

Lot No. 1 received a daily feed of ear corn, equivalent to 7½ pounds shelled corn; 2 pounds cottonseed meal per steer; and corn silage and clover hay according to appetite. Lot 2 received the same feed with the exception of the ear corn, which was omitted from the ration.

The essential facts in connection with this feeding trial are presented in Table I.

A light corn ration was compared with a ration containing no corn, except that contained in the silage which was fed in both cases. All steers were allowed 2 pounds cottonseed meal each daily, and all the silage and clover hay they cared for. Fed from January 4, 1922 to May 17, 1922—133 days.

TABLE 1.—STEER FEEDING TRIAL, 1921-22

Ration	Lot I 7.5 pounds corn 2 pounds cotton seed meal, clover hay, corn silage	Lot 2 No corn 2 pounds cotton-seed meal, clover hay, corn silage
Number of steers per lot	10	10
Number of hogs following	10	7
Cost of steers laid down, per cwt.	$5.85	$5.85
Average weight of steers at start, pounds	800	806.6
Average weight of steers at end, pounds	1,090	1,091
Average daily gain, pounds	2.18	2.14
Average daily feed: Shelled corn (fed as ear corn)	7.5	.....
Cottonseed meal	2.0	2.0
Clover hay	.8	.9
Corn silage	36.4	49.8
Feed required for 100 pounds gain: Shelled corn (fed as ear corn)	344	.....
Cottonseed meal	92	93
Clover hay	35	41
Corn silage	1,671	2,330
Cost of feed for 100 pounds gain*	$9.16	$8.14
Selling price at farm (on basis of 3 percent shrink)	$7.47	$7.47
Returns per steer over feed costs (including hog profits)	$21.55	$17.04

The above results show that steer feeding on either ration was profitable, in that each steer on the limited corn ration yielded a return of $21.55 over market prices of feeds, while each steer on the heavy silage ration returned $17.04 over feed cost. This relationship of the two rations as to profitableness is in agreement with similar rations fed to steers at the Experiment Station at Wooster during approximately the same period. In both cases, the more corn fed the greater the profit in spite of the fact that the cheapest gains in live weight were secured with the heavy silage rations. In the above experiment the cost of 100 pounds gain was $1.02 greater for the corn-fed lot than for the heavy silage-fed lot. Even though both lots of steers sold for the same amount per hundredweight, the hogs following the corn-fed lot, due partly to the greater amount of corn picked up, partly to the high market value of hogs, made enough more profit than those behind the heavy silage-fed lot to make the Lot 1, corn-fed, steers more profitable. Ordinarily corn-fed steers command a comparatively better price on the market, which premium in addition to the greater hog profit generally more than compensates for the higher cost of gains.

The steers used in the experiment reported in the table were a rather light and common grade of feeder steers, and yielded a wider margin and greater profit, whether fed corn or no corn, than the better grade of steers used at Wooster. This is explained by the fact that the market demands were such that little preference was shown for good steers, or well-fitted steers, as compared with steers in relatively ordinary market condition.

Hogs.—Experimental hog-feeding has been started only in a limited way on account of lack of equipment. During the past winter a test was completed comparing hogs following cattle with dry-lot feeding. It is hoped to start soon a rotation for hogging-off crops. The foundation of the herd at present consists of 8 pure-bred Duroc-Jersey brood sows.

THE MAINTENANCE OF SOIL FERTILITY

DEPARTMENT OF SOILS

C. E. THORNE, Chief of Department

Two experiments with fertilizers and manure have been planned for this farm, the cropping in each case being a 4-year rotation of corn, corn, wheat, and clover. The plan of treatment in these experiments is shown in Table 2.

TABLE 2.—PLAN OF FERTILIZING, MADISON COUNTY EXPERIMENT FARM

Pounds of fertilizing materials per acre

Plot	On corn—first crop				On wheat				Total fertilizing constituents		
	Acid phosphate	Muriate potash	Nitrate soda	Manure	Acid phosphate	Muriate potash	Nitrate soda	Manure	Ammonia	Phosphoric acid	Potash
Rotation I: Corn-corn-wheat-clover. Livestock division											
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	160	.....	.....	.....	160	.....	.....	.....	.....	50	.....
3	160	80	.....	.....	160	80	.....	.....	.....	50	80
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	160	80	30	.....	160	80	30	.....	12	50	80
6	.....	.....	.....	4 T.	.....	.....	.....	4 T.	100	50	80
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	160[1]	.....	.....	4 T.[1]	160[1]	.....	.....	4 T.[1]	100	100	80
9	320[1]	.....	.....	8 T.[1]	.....	.....	.....	.....	100	100	80
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11	180[2]	.....	.....	2 T.[1]	260	.....	.....	.....	25	80	20
12	500[3]	.....	.....	.....	500[3]	.....	.....	.....	20	80	20
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rotation II: Corn-corn-wheat-clover. Grain farming division											
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	160	.....	.....	.....	160	.....	.....	.....	.....	.....	.....
3	160	12	.....	.....	160	12	.....	.....	.....	50	12
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	160	12	30	.....	160	12	30	.....	12	50	12
6	160	12	30	*	160	12	30	.....	12	50	12
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	300[3]	.....	.....	.....	300[3]	.....	.....	.....	12	50	12
9	1,000[4]	.....	.....	.....	.....	.....	.....	.....	.....	270	.....
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1]Mixed with manure—"Phosphated manure".
[2]80 pounds mixed with manure.
[3]2-8-2, factory-mixed fertilizer.
[4]Raw phosphate.
*1,000 pounds ground limestone.

Three crops of the first-year corn have been grown in this test, two of the second-year corn, and three of wheat; wheat having been grown in 1919 and 1920 with only the fertilizing planned for that crop, so that it has not yet come under the full effect of the treatment. Only one crop of clover has been harvested, the clover having failed in 1920.

Tables 3 to 7 give the yields in this test for 1920 and 1921 and the 3-year averages, and in Table 8 the results are summarized by valuing corn at half a dollar a bushel, wheat at one dollar, and hay at ten dollars a ton, and estimating the cost of fertilizing materials at $20.00 a ton for acid phosphate, $60.00 for muriate of potash and nitrate of soda, $4.00 a ton for limestone and 50 cents a ton for farm manure, all spread on the field.

Table 8 shows that acid phosphate has given a very profitable increase both when used alone (Plot 2, Rotation I) and when used as a reinforcement of manure, (compare Plots 6 and 8). The figures indicate larger increases from acid phosphate on Plot 2, Rotation II, but this indication is not supported by Plot 3. Muriate of potash has apparently caused a marked increase in yield in Rotation I and it is not likely that it would diminish the yield in the other rotation. The discrepancy seems to be due to inequalities of soil on the first 4 plots of this rotation, which will probably in part disappear as the work is continued.

As already stated, this work has not yet been in progress long enough to justify definite conclusions. It is apparently perfectly safe to assume that acid phosphate may be used with profit, because such an assumption is justified by all the experiments that have been made on soils similar to this, but it is probable that it will be found more economical to furnish nitrogen and potassium in farm manure than in chemical or commercial fertilizers.

TABLE 3.—Fertilizers and manure on CORN in corn-corn-wheat-clover rotation, Madison County Experiment Farm. Yield and increase per acre

Rotation I: Livestock farming

Plot	Treatment per acre on corn	1920 Block B				1921 Block A				3-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	
No.		*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*No.*
1	None	44.29	2,220	.....	.....	45.86	2,110	.....	.....	46.57	2,177	.....	.....	1
2	Acid phosphate, 160 lb	50.00	2,240	2.28	—43	47.57	2,320	6.19	223	51.86	2,367	4.40	182	2
3	Acid phosphate, 160 lb.; muriate potash, 80 lb	62.57	3,090	11.61	743	45.43	2,440	5.52	357	56.21	2,803	7.86	611	3
4	None	54.29	2,410	.....	.....	36.43	2,070	.....	.....	49.24	2,200	.....	.....	4
5	Acid phos., 160 lb.; mur. pot., 80 lb.; nit. soda, 30 lb.	65.14	2,990	10.57	580	47.86	2,390	10.86	357	59.86	2,740	9.71	541	5
6	Manure, untreated, 4 tons	61.14	2,600	6.28	190	48.57	2,270	11.00	273	57.50	2,610	6.45	412	6
7	None	55.14	2,410	.....	.....	38.14	1,960	.....	.....	51.95	2,197	.....	.....	7
8	Manure, phosphated, 4 tons*	66.57	2,770	9.81	250	50.00	2,390	11.72	417	61.83	2,687	9.30	382	8
9	Manure, phosphated, 8 tons*	70.57	3,070	12.19	440	53.57	2,570	15.14	583	64.28	3,000	11.17	588	9
10	None	60.00	2,740	.....	.....	38.57	2,000	.....	.....	53.69	2,520	.....	.....	10
11	Manure, phosphated, 2 tons;* acid phosphate, 100 lb.†	58.86	2,680	—0.85	0	50.00	2,140	11.91	150	59.76	2,660	6.01	152	11
12	2-8-2 factory mixed fertilizer, 500 lb.	61.14	2,640	1.71	20	39.86	1,930	2.24	—50	57.10	2,690	3.28	194	12
13	None	59.14	2,560	.....	.....	37.14	1,970	.....	.....	53.88	2,483	.....	.....	13
	Average unfertilized yield	54.57	2,468	.....	.....	38.83	2,022	.....	.....	51.07	2,315	.....	.....	
	Average fertilized yield	62.00	2,760	.....	.....	37.86	2,306	.....	.....	58.55	2,694	.....	.....	

*40 pounds of acid phosphate per ton of manure.
†In addition to the phosphate in the manure.

TABLE 4.—Residual effect of fertilizers and manure on second crop CORN in corn-corn-wheat-clover rotation, Madison County Experiment Farm. Yield and increase per acre

Rotation I: Livestock farming

Plot	Treatment per acre on first crop corn—second crop corn untreated	1920 Block C				1921 Block B				2-year average				Plot
		Yield		Increase		Yield		Increase		Yield		Increase		
		Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover	
		Bu.	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	*Bu.*	*Lb.*	
1	None	53.43	2,320	.....	.....	27.43	1,800	.....	.....	40.43	2,060	.....	.....	1
2	Acid phosphate, 160 lb	51.43	2,400	—1.24	53	30.00	1,850	0.86	0	40.71	2,125	—0.19	26	2
3	Acid phosphate, 160 lb.; muriate potash, 80 lb	60.29	2,700	8.39	327	34.57	1,900	3.71	—10	47.43	2,295	6.05	158	3
4	None	51.14	2,400	.....	.....	32.57	1,950	.....	.....	41.85	2,175	.....	.....	4
5	Acid phos., 160 lb.; mur. pot., 80 lb.; nit. soda, 30 lb	61.43	3,200	7.91	780	38.00	2,480	3.72	530	49.71	2,840	5.81	655	5
6	Manure, untreated, 4 tons	56.57	2,400	.66	—41	35.00	2,050	—1.00	100	45.78	2,225	—0.17	30	6
7	None	58.29	2,460	.....	.....	37.71	1,950	.....	.....	48.00	2,205	.....	.....	7
8	Manure, phosphated, 4 tons*	65.57	2,700	5.90	193	42.00	2,010	3.76	43	53.28	2,355	4.83	118	8
9	Manure, phosphated, 8 tons*	66.57	2,800	7.52	247	46.00	2,220	7.24	237	56.28	2,510	7.38	242	9
10	None	59.43	2,600	.....	.....	39.29	2,000	.....	.....	49.36	2,300	.....	.....	10
11	Manure, phosphated, 2 tons; acid phosphate, 100 lb.†	61.43	2,640	2.57	0	45.00	2,180	6.66	190	53.21	2,410	4.61	95	11
12	2-8-2 factory-mixed fertilizer, 500 lb	60.00	2,840	1.62	160	47.57	2,140	10.19	160	53.78	2,490	5.95	160	12
13	None	57.71	2,720	.....	.....	36.43	1,970	.....	.....	47.07	2,345	.....	.....	13
	Average unfertilized yield	56.00	2,500	.....	.....	34.67	1,934	.....	.....	45.33	2,217	.....	.....	
	Average fertilized yield	60.29	2,710	.....	.....	39.77	2,103	.....	.....	50.03	2,406	.....	.....	

*40 pounds of acid phosphate per ton of manure.
†In addition to the phosphate in the manure.

TABLE 5.—Fertilizers, manure, and limestone on CORN in corn-corn-wheat-clover rotations, Madison County Experiment Farm. Yield and increase per acre

Rotation II: Grain farming

Plot No.	Treatment per acre on first crop	1920 Yield Grain Bu.	1920 Yield Stover Lb.	1920 Increase Grain Bu.	1920 Increase Stover Lb.	1921 Yield Grain Bu.	1921 Yield Stover Lb.	1921 Increase Grain Bu.	1921 Increase Stover Lb.	Average Yield Grain Bu.	Average Yield Stover Lb.	Average Increase Grain Bu.	Average Increase Stover Lb.	Plot No.
	CORN, first crop	Block K				Block I				3-year average				
1	None	54.64	2,870	.....	.....	45.71	2,450	.....	.....	53.00	2,507	.....	.....	1
2	Acid phosphate, 160 lb	66.07	3,350	11.10	430	50.43	2,610	3.96	40	62.86	2,867	8.58	221	2
3	Acid phosphate, 160 lb.; muriate potash, 12 lb	62.14	2,920	6.83	—50	49.71	2,760	2.47	70	60.90	2,647	5.35	—138	3
4	None	55.64	3,020	.....	.....	48.00	2,810	.....	.....	56.83	2,923	.....	.....	4
5	Acid phos., 160 lb.; mur. pot., 12 lb.; nitrate soda, 30 lb.	69.29	3,280	9.55	113	49.57	3,300	—0.24	467	63.29	3,100	4.29	156	5
6	Acid phos., 160 lb.; mur. pot., 12 lb.; nitrate soda, 30 lb.; ground limestone, 1000 lb	78.86	4,340	15.03	1,027	51.71	3,060	0.09	203	66.29	3,420	5.12	454	6
7	None	67.93	3,460	.....	.....	53.43	2,880	.....	.....	63.33	2,987	.....	.....	7
8	2-8-2 factory-mixed fertilizer, 300 lb.	74.29	3,710	9.53	520	56.14	3,110	4.19	307	66.55	3,353	5.96	473	8
9	Raw phosphate rock, 1,000	68.48	3,110	6.83	190	48.86	2,800	—1.62	73	58.19	2,817	0.35	43	9
10	None	58.43	2,650	.....	.....	49.00	2,650	.....	.....	55.10	2,667	.....	.....	10
	Average unfertilized yield	59.16	3,000	.....	.....	49.03	2,697	.....	.....	57.06	2.771	.....	.....	
	Average fertilized yield	69.85	3,452	.....	.....	51.07	2,940	.....	.....	63.01	3,034	.....	.....	
	CORN, second crop	Block L				Block K				2-year average				
1	No treatment on second crop	39.57	2,260	.....	.....	33.14	2,660	.....	.....	36.35	2,460	.....	.....	1
2		43.50	2,290	3.41	60	41.86	2,870	6.53	240	42.68	2,580	4.97	150	2
3		43.86	2,130	3.24	—70	41.57	2,780	4.05	180	42.71	2,455	3.64	55	3
4		41.14	2,170	.....	.....	39.71	2,570	.....	.....	40.42	2,370	.....	.....	4
5		43.36	2,510	2.46	210	46.14	2,870	4.14	157	44.75	2,690	3.30	183	5
6		42.71	2,420	2.04	—10	54.71	3,240	10.43	383	48.71	2,830	6.23	186	6
7		40.43	2,560	.....	.....	46.57	3,000	.....	.....	43.50	2,780	.....	.....	7
8		50.21	2,900	8.95	407	54.29	3,090	11.24	153	52.25	2,995	10.09	280	8
9		44.86	2,740	2.76	313	54.43	3,130	14.91	257	49.64	2,935	8.83	285	9
10		42.93	2,360	.....	.....	36.00	2,810	.....	.....	39.46	2,585	.....	.....	10
	Average unfertilized yield	41.02	2,337	.....	.....	38.86	2,760	.....	.....	39.94	2,548	.....	.....	
	Average fertilized yield	44.75	2,498	.....	.....	48.83	2,997	.....	.....	46.79	2,747	.....	.....	

TABLE 6.—Fertilizers and manure on WHEAT in corn-corn-wheat-clover rotations, Madison County Experiment Farm
Yield and increase per acre

Plot	Treatment per acre on wheat	1920 Yield Grain Bu.	1920 Yield Straw Lb.	1920 Increase Grain Bu.	1920 Increase Straw Lb.	1921 Yield Grain Bu.	1921 Yield Straw Lb.	1921 Increase Grain Bu.	1921 Increase Straw Lb.	Average Yield Grain Bu.	Average Yield Straw Lb.	Average Increase Grain Bu.	Average Increase Straw Lb.	Plot
	Rotation I: Livestock farming	Block D				Block C				3-year average				
1	None	19.83	2,490			15.83	1,450			21.00	2,573			1
2	Acid phosphate, 160 lb	28.67	2,680	9.98	275	18.33	1,800	305	317	25.86	2,862	5.72	319	2
3	Acid phosphate, 160 lb.; muriate potash, 80 lb	32.25	3,165	14.69	845	20.17	1,890	545	373	27.86	3,022	8.58	509	3
4	None	16.42	2,235			14.17	1,550			18.42	2,482			4
5	Acid phos., 160 lb.; mur. pot., 80 lb.; nitrate soda, 30 lb	20.58	3,265	4.19	1,128	22.33	2,160	855	670	24.55	3,200	6.44	837	5
6	Manure, untreated, 4 tons	20.75	2,395	4.39	357	16.67	1,600	328	170	21.11	2,553	3.31	308	6
7	None	16.33	1,940			13.00	1,370			17.50	2,127			7
8	Manure, phosphated*, 4 tons	22.17	2,210	7.01	427	15.83	1,400	244	70	22.36	2,375	5.08	338	8
9	Acid phosphate, 320 lbs	27.33	2,480	13.33	853	20.00	1,800	622	510	26.53	2,582	9.47	635	9
10	None	12.83	1,470			14.17	1,250			16.83	1,857			10
11	Acid phosphate, 260 lbs	21.00	2,000	9.61	610	17.67	1,740	372	510	23.31	2,355	6.97	453	11
12	2-8-2 factory-mixed fertilizer, 500 lbs.	20.33	1,820	10.39	510	17.67	1,840	395	630	22.58	2,472	6.75	524	12
13	None	8.50	1,230			13.50	1,190			15.33	1,993			13
	Average unfertilized yield	14.78	1,873			14.13	1,362			17.81	2,206			
	Average fertilized yield	24.13	2,502			18.58	1,779			24.27	2,678			
	Rotation II: Grain farming	Block M				Block L				3-year average				
1	None	10.08	1,195			9.50	1,130			9.79	1,162			1
2	Acid phosphate, 160 lb	19.33	1,700	7.75	395	12.33	1,660	2.89	493	15.83	1,680	5.32	444	2
3	Acid phosphate, 160 lb.; muriate potash, 12 lb.	18.58	1,385	5.50	—30	12.50	1,250	3.11	47	15.54	1,317	4.30	8	3
4	None	14.58	1,525			9.33	1,240			11.95	1,382			4
5	Acid phos., 160 lb.; mur. pot., 12 lb.; nitrate soda, 30 lb.	27.42	2,355	14.78	953	15.00	1,800	6.28	723	21.21	2,077	10.53	838	5
6	Acid phos., 160 lb.; mur. pot., 12 lb.; nitrate soda, 30 lb*	24.25	1,985	13.56	707	13.33	1,400	5.22	487	18.79	1,692	9.39	597	6
7	None	8.75	1,155			7.50	750			8.12	952			7
8	2-8-2 factory-mixed fertilizer, 300 lb	16.92	1,325	7.59	178	12.50	1,050	5.11	360	14.71	1,187	6.35	269	8
9	Raw phosphate, 1,000 lbs. on corn, only	8.92	785	—1.00	—353	8.33	900	1.05	270	8.62	842	0.02	—41	9
10	None	10.50	1,130			7.17	570			8.83	850			10
	Average unfertilized yield	10.98	1,251			8.37	922			9.67	1,086			
	Average fertilized yield	19.24	1,589			12.33	1,343			15.78	1,466			

*40 pounds acid phosphate per ton of manure.

*Ground limestone, 1,000 pounds on corn.

TABLE 7.—Residual effect on CLOVER of fertilizers, manure, and limestone applied to previous crops of rotations, Madison County Experiment Farm. Yield and increase per acre

Plot	Total treatment per acre on previous crops of rotation	1921—Block D		Plot
		Yield Lb.	Increase Lb.	
	Rotation I. Livestock farming			
1	None	4,267	.....	1
2	Acid phosphate, 320 lb	4,622	414	2
3	Acid phosphate, 320 lb.; muriate potash, 160 lb	4,622	474	3
4	None	4,089	.....	4
5	Acid phosphate, 320 lb.; muriate potash, 160 lb.; nitrate soda, 60 lb.	4,267	356	5
6	Manure, untreated, 8 tons (Half on corn, half on wheat)	4,533	799	6
7	None	3,556	.....	7
8	Manure, phosphated,* 8 tons (Half on corn, half on wheat)	4,800	1,096	8
9	Manure, phosphated,* 8 tons (All on corn)	4,000	148	9
10	None	4,000	.....	10
11	Manure phosphated,* 2 tons; acid phosphate, 360 lb.†	4,467	437	11
12	2-8-2 factor-mixed fertilizer, 1,000 lb	4,356	297	12
13	None	4,089	.....	13
	Average unfertilized yield	4,000	.....	
	Average fertilized yield	4,461	.....	
	Rotation II. Grain farming	1921—Block M		
1	None	1,600	.....	1
2	Acid phosphate, 320 lb	2,933	1,007	2
3	Acid phosphate, 320 lb.; muriate potash, 24 lb	3,111	859	3
4	None	2,578	.....	4
5	Acid phosphate, 320 lb.; muriate potash, 24 lb.; nitrate soda, 60 lb.	3,467	1,156	5
6	Acid phos., 320 lb.; mur. potash, 24 lb.; nitrate soda, 60 lb; ground limestone, 1,000 lb	3,289	1,244	6
7	None	1,778	.....	7
8	2-8-2 factory-mixed fertilizer, 600 lb	2,489	444	8
9	Raw phosphate, 1000 lb	1,956	−355	9
10	None	2,578	.....	10
	Average unfertilized yield	2,133	.....	
	Average fertilized yield	2,874	.....	

*10 pounds acid phosphate per ton of manure. †Additional to that mixed with manure.

TABLE 8.—Value of increase, cost of treatment, and balance per acre for 4-year period in corn-corn-wheat-clover rotations, Madison County Experiment Farm

Plot No.	Treatment per acre for entire rotation	Value of increase	Cost of treat	Balance	Plot No.
	Rotation I: Livestock Farming				
2	Acid phosphate, 320 lb	$10.62	$ 3.20	$ 7.42	2
3	Acid phosphate, 320 lb.; muriate potash, 160 lb	19.42	8.00	11.42	3
5	Acid phos., 320 lb.; muriate potash, 160 lb.; nitrate soda, 60 lb	19.20	9.80	9.40	5
6	Manure, untreated, 8 tons (Half on corn, half on wheat)	11.64	4.00	7.64	6
8	Manure, phosphated,* 8 tons (Half on corn, half on wheat)	18.93	7.20	11.73	8
9	Manure, phosphated.* 8 tons (All on corn)	21.76	7.20	14.56	9
11	Manure, phosphated, 2 tons; acid phosphate, 360 lb.†	15.39	4.60	10.79	11
12	2-8-2, factory-mixed fertilizer, 1,000 lb	14.07	13.00	1.07	12
	Rotation II: Grain farming				
2	Acid phosphate, 320 lb	18.30	3.20	15.10	2
3	Acid phosphate, 320 lb.; muriate potash, 24 lb	12.94	3.92	9.02	3
5	Acid phos., 320 lb.; mur. potash, 24 lb.; nitrate soda, 60 lb	21.61	5.72	15.89	5
6	Acid phos., 320 lb.; mur. potash, 24 lb.; nit. soda, 60 lb.; limestone, 1,000 lb	23.15	7.72	15.43	6
8	2-8-2 factory-mixed fertilizer, 600 lb	18.36	7.80	10.56	8
9	Raw phosphate, 1,000	3.44	7.50	−4.06	9

*40 pounds acid phosphate per ton of manure. †Additional to that mixed with manure.

VARIETY COMPARISONS

DEPARTMENT OF AGRONOMY

CORN

Seven varieties of corn have been tested for four years. The yields are reported in bushels of ear-corn at husking time. Table 9. Darke County Mammoth has the highest yield with 58.43 bushels; Leaming P. D. second, 55.76 bushels; and Cook's 75 third, 53.42 bushels per acre.

OATS, SPRING WHEAT, AND BARLEY

Table 10 gives the yield of oats, spring wheat, and barley. Four varieties have been tested for the full five-year period, three for four years, and one for three years.

On the average, Silver Mine has the highest yield, 52.28 bushels; Miami, second, 52.12 bushels; and Big Four, third, 50.26 bushels per acre. Barley and spring wheat have low average yields in comparison with oats.

WHEAT

The yields of seven varieties of wheat are reported for three years in Table 11. The yields in 1920 were not reliable and are not reported. The test is too short to be of much value, but to date, Ohio 9920 has the highest yield, 24.57 bushels; Gladden second, 23.14 bushels; Red Wave third, 23.07 bushels; and Trumbull fourth 22.54 bushels per acre.

SOYBEANS

A test of soybeans for seed production in 1917 showed Ohio 9100 to be the best yielder, Elton second, and Ohio 9016 third. Table 12. A three-year test of varieties for hay is also given in the table. The yields have varied from 2.10 tons to 1.28 tons per acre. Hamilton is first, Elton second, and Ebony third. Mammoth Yellow, a late variety, seed of which is produced in the southern states, is the lowest yielder of all.

TABLE 9.—VARIETIES OF CORN, YIELD PER ACRE

Variety	1917	1919	1920	1921	4-year average	
					Grain	Stover*
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Darke Co. Mammoth	70.03	48.89	70.38	44.42	58.43	2,930
Leaming P. D.	62.47	43.79	69.21	47.57	55.76	2,427
Cook's 75	51.43	49.77	65.57	46.94	53.42	2,770
Ohio 84	63.38	42.27	62.45	34.62	50.68	2,310
White Cap	56.17	43.62	57.93	33.19	47.73	2,450
Clarage	60.46	43.34	63.12	34.71	50.41	2,497
Johnson Co. White	.....	43.19	56.24	.....	.....	4,090

*Stover, 3-year average, not weighed in 1917.

TABLE 10.—VARIETIES OF OATS, YIELD PER ACRE

Variety	1917	1918	1919	1920	1921	4-year average	
						Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*
Wideawake	55.83	38.75	39.63	61.11	33.23	45.71	2,032
Ohio 7009	58.73	.....	28.85	.....	28.78	38.79	968
Miami (Ohio-6203)	59.59	.....	45.57	71.49	31.83	52.12	1,720
Ohio 6222	54.51	.....	41.81	60.52	29.56	46.60	1,897
Big Four	59.19	37.34	44.59	76.42	33.78	50.26	1,960
Silver Mine	60.05	37.19	46.11	82.17	35.89	52 28	1,746
Oderbrucker barley	22.81	12.71	23.96	33.44	17.71	22.13	1,860
Blue Ribbon spring wheat	24.17	.....	4.17	24.50	7.50	15.08	1,837

TABLE 11.—VARIETIES OF WHEAT, YIELD PER ACRE

Variety	1918	1919	1921	3-year average	
				Grain	Straw
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*
Velvet Chaff	13.12	32.20	17.42	20.91	3,184
Nigger	13.51	31.53	18.86	21.30	2,437
Gladden	13.57	32.20	23.64	23.14	3,239
Ohio 8106	10.40	28.42	.....	19.41	3,480
Trumbull	16.51	28.14	22.98	22.54	2,762
Ohio 9920	16.73	34.97	22.03	24.57	2,775
Red Wave	15.18	32.40	21.64	23.07	3,038

TABLE 12.—VARIETIES OF SOYBEANS, YIELD PER ACRE

Variety	Grain	Hay				
	1917	1919	1920	1921	3-year average	
	Bu.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Tons*
Ohio 9100	18.66	3,500	4,061	3,167	3,576	1.79
Elton	15.67	.....	4,748	3,383	4,065	2.03
Ebony	13.78	3,560	4,268	3,717	3,848	1.92
Hamilton (Ohio—9035)	12.06	3,340	6,581	2,683	4,201	2.10
Ohio 9016	15.29	.....	3,335	1,583	2,459	1.22
Medium Green	14.67	3,915	4,475	2,550	3,647	1.82
Auburn	.....	4,100	.....	.....	.....	.....
Cloud	.....	4,440	.....	.....	.....	.....
Mammoth Yellow	.....	2,700	2,875	2,117	2,564	1.28
New Era cowpea	2.50	.....	.....	.....	.....	.....

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APPENDIX

VARIETY COMPARISONS

The results of the variety tests on the fourteen experiment farms of the State are summarized in the following tables.

Sixteen varieties of corn have been tested on the several experiment farms. The yields from these tests are reported in the table as bushels of corn at husking time. The yields at Wooster are reported as bushels of dry shelled corn and a conversion factor given whereby the same may be converted to bushels of ear corn if desired. These factors may also be used to convert the ear corn yields of the county and district farms to shelled corn; the figure obtained being an approximation only, since the factor was obtained from yields on the Wooster farm.

Leaming (P. D.), Medina Pride, Clarage, and Ohio 84 are medium early and good yielders of sound corn. Darke County Mammoth, Cook's 75, Reid (Orcutt), and Leaming (Frost) are somewhat later and are likely to carry more moisture at husking time.

Among the different varieties of oats tested, Silver Mine, Miami, Ohio 6222, Big Four, and Swedish Select have yielded highest in about the order named—an exact comparison is not possible because of some breaks in the record. On rich land, Silver Mine is likely to lodge. Miami, a selection of Siberian, formerly known as Ohio 6203, is a rather stiff-strawed variety that is making a good showing for yield and quality of grain.

The leading varieties of wheat are Ohio 9920, Gladden, Fulhio, Portage, and Trumbull. Of these Gladden, Portage, and Trumbull have been tested the longest. Ohio 9920 and Fulhio, for the shorter period, have made a splendid showing. Of the older sorts, of good milling qualities, Nigger, Poole, Fultz, Valley, and Rudy are giving satisfaction.

In the soybean test, the better varieties are Elton, Midwest, Ebony, Ohio 9100, and Hamilton. In selecting a variety of soybeans for seed production, the length of the growing season should be considered, as there is a marked difference in the date of maturity of varieties.

SUMMARY OF VARIETY TESTS OF CORN, YIELD IN BUSHELS, 70 POUNDS OF EARS, PER ACRE

Variety	Wooster 16-years Shelled*	Conversion factor*	Germantown 16 years	Carpenter 14 years	Findlay 10 years	Miami 9-years	Hamilton 9 years	Paulding 9 years	Clermont 9 years	Trumbull 5 years	Strongsville 6 years	Mahoning 4 years	Washington 8 years	Belmont 5-years	Madison 4 years
Leaming P. D.	67.73	.8449	58.46	56.29	63.30	55.22	51.60	59.74	25.88	.....	.....	81.93[1]	53.06	74.20	55.76
Darke Co. Mammoth	63.92	.7746	60.38	59.22	61.73	63.62	58.92	60.46	27.58	.....	.....	74.72	54.81	78.87	58.43
White Cap	65.18[10]	.9076	50.40 [9]	55.81 [2]	51.43 [8]	55.11	49.53 [8]	51.15 [6]	19.62 [8]	61.89	62.11	68.18	49.99[3]	69.13	47.73
Ohio 84	66.69	.8586	51.52[14]	49.98[11]	61.80	52.98	45.69	56.08	19.31 [7]	64.74	70.04	71.89	52.22	71.70	50.68
Medina Pride	68.12	.8667	.....	56.90 [7]	56.64 [8]	.....	.....	.....	.....	64.52	66.16	74.17	.....	.....	.....
Cook's 75	65.05[12]	.8274	59.13[12]	58.72[12]	61.09	60.72	56.91	65.03	24.40	.....	.....	.....	62.24[7]	82.11	53.42
Clarage	63.95	.8526	53.33	53.49	57.72	56.30	49.94	58.89	23.64	64.37	64.07	69.03	52.21	72.39	50.41
Reid (Orcutt)	62.85[10]	.7912	56.90 [9]	57.35 [9]	65.96 [7]	60.75	58.38	61.07	29.55	.....	.....	.....	53.79[5]	.....	.....
Boone Co. White	54.54[10]	.7021	58.15	55.62[13]	72.26	65.23 [8]	.....	.....	.....	.....	.....	.....	.....	.....	.....
Leaming (Frost)	66.73[10]	.8240	.....	.....	.....	.....	.....	.....	.....	65.51	67.77	80.16	.....	.....	.....
Pride of the North	54.61 [6]	.9171	.....	.....	.....	.....	.....	.....	.....	56.31	.....	62.92	.....	.....	.....
Golden Glow	57.22 [6]	.9222	.....	.....	.....	.....	.....	.....	.....	58.71	.....	65.43	.....	.....	.....
Minnesota No. 13	56.06 [5]	.9303	39.06 [5]	.....	.....	.....	.....	.....	.....	53.32	.....	.....	.....	.....	.....
Calico (Stone)	59.82 [5]	.9775	.....	.....	.....	.....	.....	.....	.....	49.74	.....	56.56[1]	.....	.....	.....
Connor's Prolific	32.93 [5]	.5609	54.56 [9]	58.04 [7]	.....	53.70	61.58 [6]	.....	.....	.....	.....	.....	55.81[7]	.....	.....
Stauffers Yellow Dent	64.14[11]	.9000	48.11[10]	52.46[10]	.....	.....	.....	.....	.....	58.60 [3]	.....	.....	.....	.....	.....

*Rule—To convert bushels of ear corn to bushels of shelled corn multiply by the factor.
To convert bushels of shelled corn to bushels of ear corn, divide by the factor.
Small figures indicate number of years the varieties have been tested.

SUMMARY OF VARIETY TESTS OF WHEAT, YIELD IN BUSHELS PER ACRE

Variety	Wooster	Germantown	Carpenter	Hancock	Miami	Hamilton	Paulding	Clermont	Trumbull	Strongsville	Mahoning	Washington	Belmont	Madison
	12 yrs.	11 yrs.	12 yrs.	6 yrs.	9 yrs.	8 yrs.	8 yrs.	8 yrs.	6 yrs.	6 yrs.	4 yrs.	6 yrs.	4 yrs.	3 yrs.
Fultz	32.09	22.70	26.73	17.16[5]	29.31	.....	.....	.....	31.51	.....	31.17	.....	.....	.....
Trumbull	33.63	24.30	27.23	22.41	33.31	.....	30.21	12.18[6]	30.21	30.59	29.26	16.83[5]	26.35	22.54
Poole	32.95	23.47	26.80	18.55[5]	30.23	.....	.....	.....	27.73	.....	27.08	.....	.....	.....
Portage	34.45	24.68	29.86	.....	32.05	26.44	27.40	15.86	30.61	.....	27.96	.....	.....	.....
Gypsy	32.32	23.46	27.07	19.23[5]	33.62	29.81[2]	.....	.....	.....	.....	29.71	.....	.....	.....
Gladden	36.16	23.71	27.96[11]	23.79	35.08	29.61	28.44	18.04	32.76	29.65	29.83	21.97	32.35	23.14
Mediterranean	31.91	22.19[10]	27.02	20.44[4]	31.18[7]	28.26[6]	24.93[7]	17.16[7]	26.07[5]	29.25	23.33[2]	25.00[4]	....	.....
Turkey Red	27.33	21.60[10]	22.68	16.91[5]	29.10	28.15[7]	29.53	11.89[6]	.....	.....	.....	.....	.....	.....
Valley	33.68	23.43[10]	27.47	.....	32.27	.....	.....	.....	32.56	.....	30.52	.....	... .	.....
Goens	33.20[9]	.....	.....	.....	30.58	25.98	25.56[6]	.....	28.76[5]	.....	24.87[3]	.....	.....	.....
Nigger	33.80	24.04[10]	27.05	17.19	31.50	24.50[7]	26.21	17.53[7]	25.78[5]	29.64	26.48	22.24	27.55	21.30
Dawson's Golden Chaff	35.94	24.49	.....	20.80	.....	.....	.....	.....	30.33	.....	27.35	.....	.....	.....
Red Wave	34.39	.....	.....	.....	.....	27.57	.....	.....	30.74[5]	30.77[5]	29.25[3]	15.71	33.29	23.07
Velvet Chaff	30.00	21.22[10]	25.15	15.19	29.97	25.23	25.54	16.03	27.09	25.43	24.88	18.13	29.01	20.91
Ohio 9920	35.89[8]	24.69[6]	31.32[5]	20.19	30.11	29.09[6]	.....	.....	30.36	31.82	30.76	20.45	30.30	24.57
Fulhio	37.12[6]	21.24[5]	25.69	....	.....	29.31[5]	.....	.....	32.33	.....	30.54	.....	28.61	.....
Rudy	33.55	24.04[10]	.....	.....	31.91	.....	27.18	15.41	.....	.....	.....	.....	.....	.....
Spring wheat (blue ribbon)	15.66[10]	.....	7.16[4]	15.08[4]	11.46[4]	12.87[4]	8.33[3]	.....	13.72[6]	21.92[5]	13.91[6]	.....	10.75[5]	15.08[4]

Small figures denotes number of years tested when less than given at top of column.

SUMMARY OF VARIETY TESTS OF OATS, YIELD IN BUSHELS PER ACRE

Variety	Wooster 12 years	Carpenter 11 years	Hancock 11 years	Miami 10 years	Hamilton 9 years	Paulding 10 years	Clermont 8 years	Trumbull 7 years	Strongsville 6 years	Mahoning 6 years	Belmont 5 years	Madison 4 years
Big Four	66.39	.....	47.22	61.16	51.39	64.93	29.36	53.12	74.96	54.64	63.26[3]	50.26
Silver Mine	68.08	.....	49.88	59.22	48.56	58.74	29.44	54.02	75.87	55.52	55.52[3]	52.28
Ohio 7009	65.42	.....	43.23	55.93	40.54	54.94[6]	28.30[7]	42.01	62.88	42.61	43.11	38.79[3]
Miami (Ohio 6203)	69.07	34.88	49.71	64.03	42.99	57.75	28.34	51.37	61.65	57.79	53.43	52.12[4]
Wideawake	58.45	30.50	43.05	56.04	42.69	51.31	27.41	48.06	69.77	47.57	52.77	45.71
Ohio 6222	67.86	.....	51.17[9]	59.60	44.48	67.05	23.95	48.99	75.06	57.25	50.80	46.60[4]
Swedish Select	57.42	.....	47.68	56.60	42.75	56.36	26.10	49.15	70.61	48.37	.....	.....
Sixty Day (Ohio)	66.07	34.95	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sixty Day (N. Dakota)	69.03	40.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oderbrucker Barley	31.97	16.67[10]	26.03[9]	33.79	22.07	37.05[8]	.....	21.69	.....	22.06	25.00	22.13
Emmer	27.87	20.23[6]	31.49[6]	36.07[6]	24.20[5]	.....	.....	24.83	.....	27.89	.....	.....

SUMMARY OF VARIETY TESTS OF SOYBEANS, YIELDS IN BUSHELS PER ACRE

Variety	Wooster 8 years	Carpenter 4 years	Miami 8 years	Hamilton 9 years	Paulding 7 years	Clermont 7 years	Trumbull 4 years	Mahoning 1 year	Washington 2 years	Belmont 2 years	Madison 1 year
Ohio 9100	20.89	19.90	18.29	17.19	15.76[3]	6.23	14.98	6.53	14.97	10.28	18.65
Ebony	24.63	18.96	23.74	18.35	.....	9.18	15.70	8.01	12.25	8.37	13.78
Elton	27.22	17.78	23.48	16.93	19.82	7 26	13.31	3.38	15.84	11.93	15.67
Midwest*	23.88[7]	20.71	21.99	21.22	.....	9.94	13.30[3]	6.67	14.70	.....	.....
Hamilton	25.64	16.78	21.74	21.09	16.88	6.69	.....	.....	16.73	7.63	12.06
Ohio 7496	25.21[7]	.....	19.05[6]	14.89[4]	13.98[6]	.....	.....	1.60	.....	.....	.....
Ohio 9016	27.78	15.89	17.11	18.13	11.35[2]	.....	9.57	1.24	.....	12.33	15.29
Medium Green	24.92	14.58	19.45	15.78	12.14	6.44	12.87	7.41	10.35	11.87	14.67
Manchuria	25.69	17.71	.....	.....	.....	.....	13.06[3]	3.49	.....	.....	.....
New Era Cowpea	7.50[3]	11.72	4.71	3.77	.....	1.85	Failure	.....	1.58	.....	2.50

*Correct name for Mongol, Hollybrook, Roosevelt, and Medium Yellow.